THE REFINER AND NATURAL GASOLINE MANUFACTURER

In This Issue

Government claims cracking processes used in violation of trust laws. Review of court brief furnishes interesting reading.

Vacuum applied in handling Coastal crudes. New process installed by South Texas refiner has many advantages.

Using Hypochlorite solution in American refineries. Method developed by Anglo Persian Oil Company meeting with approval.

California development in the preparation and use of absorptive clays in refining.

Vol. 3 No. 7 July, 1924 $1.00 Per Year

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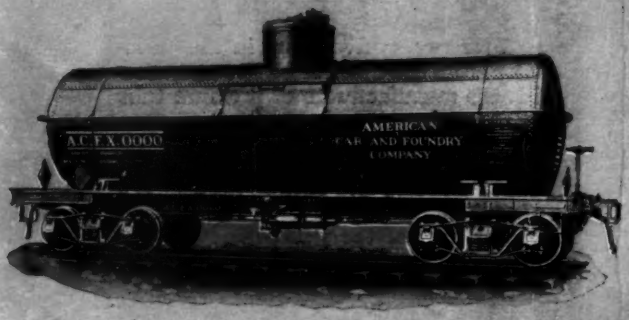

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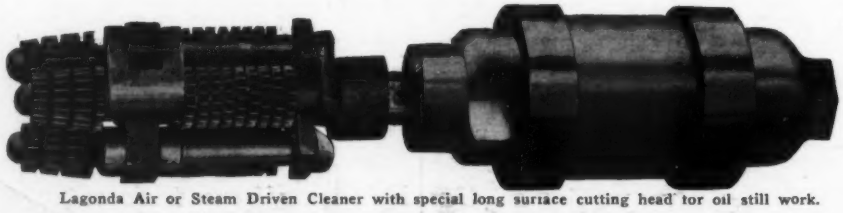

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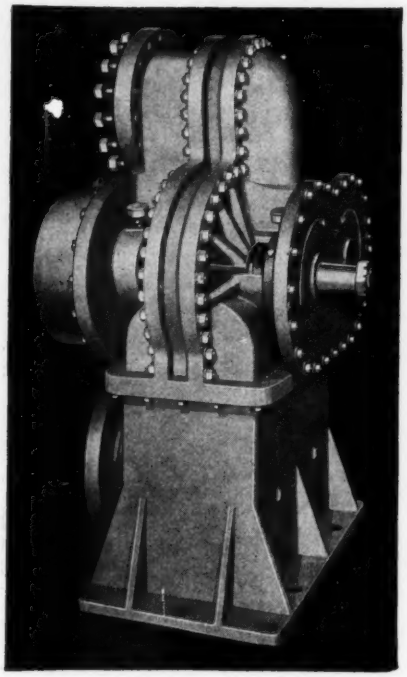

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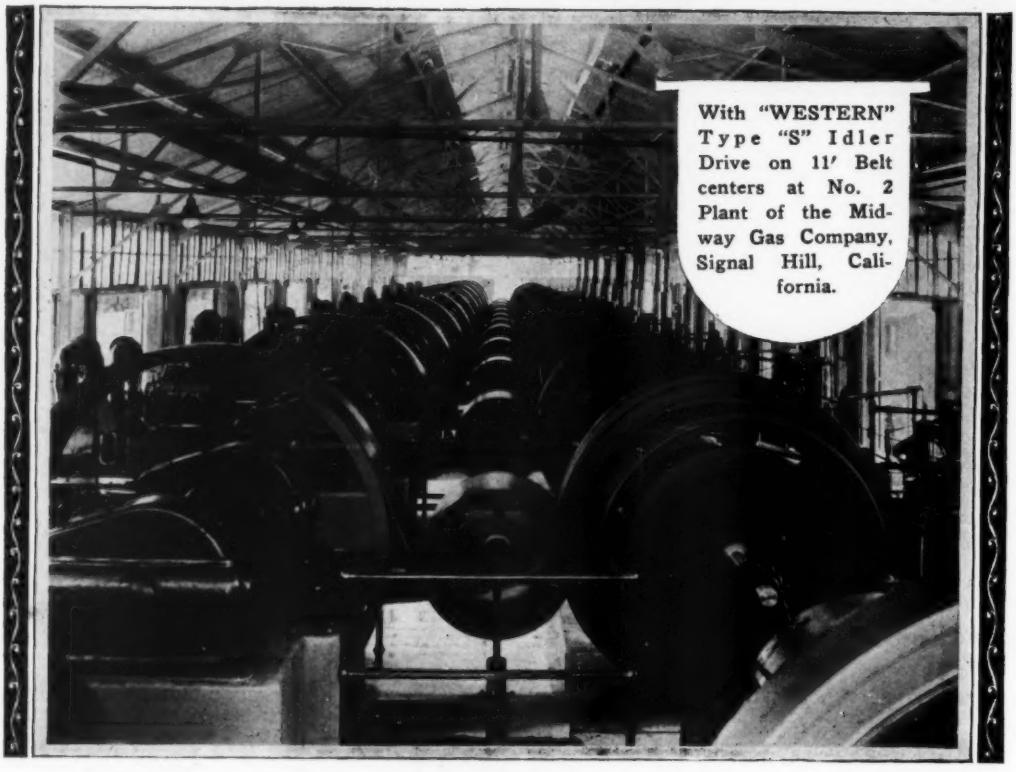

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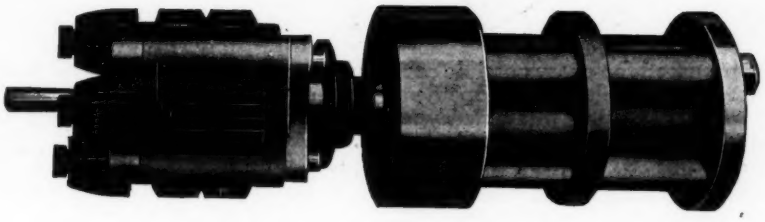

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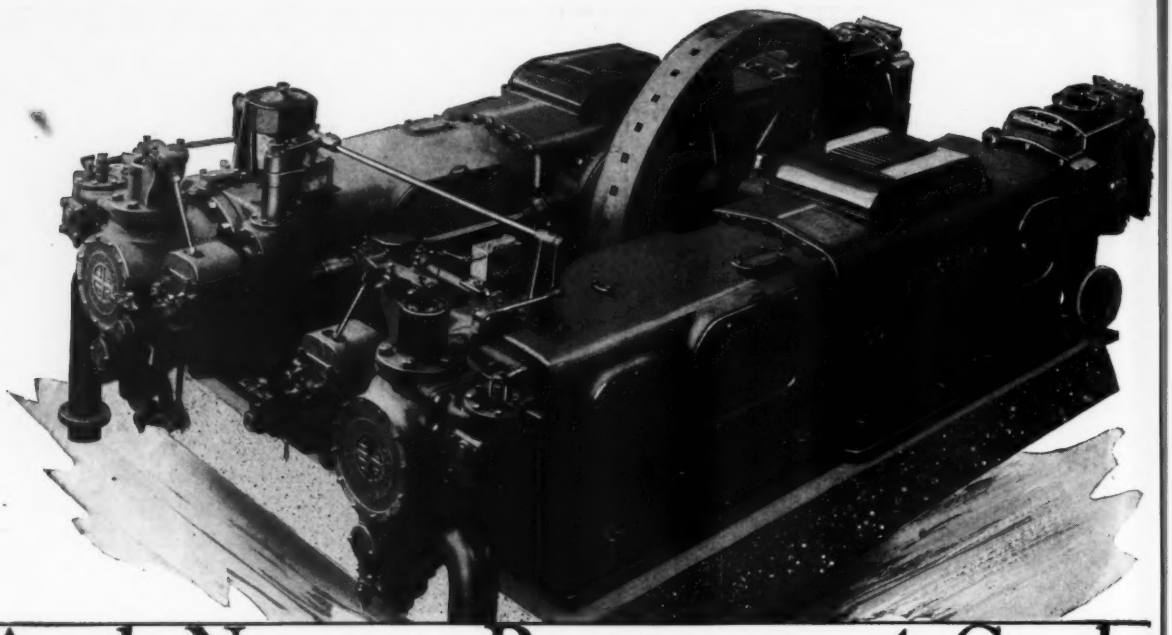

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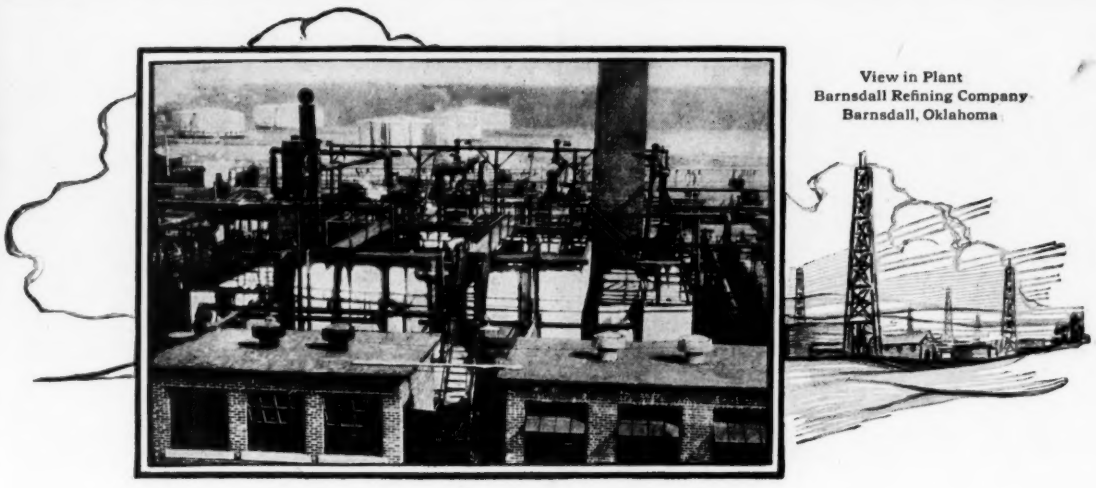

View in Plant
Barnsdall Refining Company
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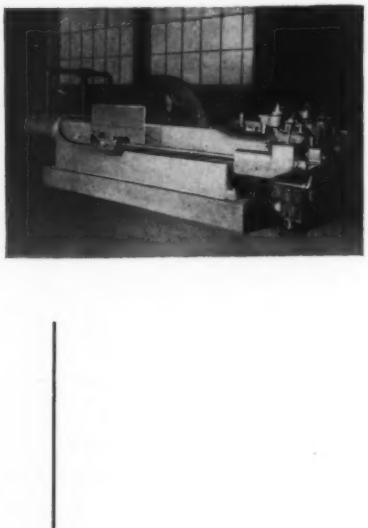

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R. L. DUDLEY..Manager and Editor

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Possible Effects From Government Suit

Recall of licenses—Suits against validity of patents and reduced output might result

WHATEVER the final settlement of the petition now pending in Chicago against the owners and users of the several cracking processes, the situation does present some phases that are worth study.

Although the federal government is not asking abrogation of patent rights, it is basing allegations of combination in restraint of trade on contentions that the patents are held chiefly to give stronger claim to the contracts, which are classed as illegal. Still, these same patents have the approval of the United States patent office and the suit now pending places the government in the attitude of using a fist of one hand to knock down what the fingers of the other have set up.

It seems safe to say that holders of the patents know of the muddle of their claims. That very fact led to the several agreements by which cracking came into common use. Rather than deny the world the benefit of cracking, holders of the patents decided upon agreement and general use of their processes, instead of a long period of litigation.

If They Win They Lose

If any condition in the field of cracking needs clarifying, it is that of the patents. But nothing in the action taken by the government at Chicago can clarify the condition of the patents. Should the government win, the patents would exist as they do now. The change would be in the tearing down of agreements between holders of the processes and the vitiating of contracts between process holders and licensees.

Right here it may be well to state that the oil industry is not taking the case as seriously as it did when the action was filed. Many believe the case will never come to trial for lack of merit. Some contend that the suit was filed for its political effect. Regardless of these views, the petition in equity is on file in the district court of the United States at Chicago, and the oil industry, especially the refining division of it, may study the situation from its effect, should all contentions of the government be upheld both in the trial court and in the higher courts.

Here is a tabloid history behind the case. Patents were allowed on several processes for cracking heavy distillates into lighter products, especially gasoline. Effects of each process was similar to every other, but methods differed. For several years, holders of the processes guarded their methods, litigation between the holders threatening at all times.

But this guarding denied the refining industry the general use of cracking. So it became the practice for holders of the patents to enter into agreements, allowing each to use parts of the other and these agreements came to have scores of manufacturing, selling and transporting conditions and restrictions, both between the patent holders and those licensing the processes. These agreements were adopted to give the refining industry the benefit of cracking, without the delay and expense of testing validity of the processes in the courts.

License Helps Small Refiner

It was under the reign of these agreements that cracking made its strides in the refining industry. The petition on file at Chicago, lists 79 contracts, many of which show that small refining concerns had adopted some cracking method by license. Without the agreements between the patent holders, these smaller concerns would have waited many years before they could have added cracking stills to their equipment.

Benefits of the agreements and licenses were accordingly enjoyed by the users of gasoline, the automobile owners. For cracking is credited with increasing the recoverable gasoline from a barrel of crude oil by two and one half times. Without it, or rather without the agreements and the licensing, which the government is seeking to annul, there would have been a gasoline shortage in recent years and the price of the product would have been twice that existing over the period.

Until the case is tried, it can not be known about the legality of the agreements and licenses existing among the owners and users of cracking units. But it does not take the trial of the case to justify the statement that the existence of these agreements and licenses is economically just.

In proof of that, take some statements from the petition:

Speaking of the methods by which holders of the patents made themselves a combination, the petition reads:

"Each thus protected its patents and asserted rights against attack by the others and they were enabled to present a solid front to all manufacturers of gasoline, who were compelled by competition to avail themselves of the economies resulting from the use of the cracking process.

"Said agreements provide for the payment of heavy royalties ranging from half a cent to a cent and a quarter per gallon on gasoline produced by cracking processes for domestic consumption."

Doesn't Hold Water

Thus in adjoining paragraphs, the drawer of the petition listed the economy of cracking and then turned about and listed the "heavy royalties." It would seem impossible for any transaction to carry an exorbitant royalty and at the same time be economical.

The full value of the economy of cracking is difficult to measure. But any method that will increase the gasoline recovery of a barrel of crude oil by two and one half times certainly deserves some consideration from its economical aspect purely.

Although no effort will be made to nullify patents, the government contends they are but a device for gaining control and monopoly. But the government would be in the position of op-

(Continued on page 24.)

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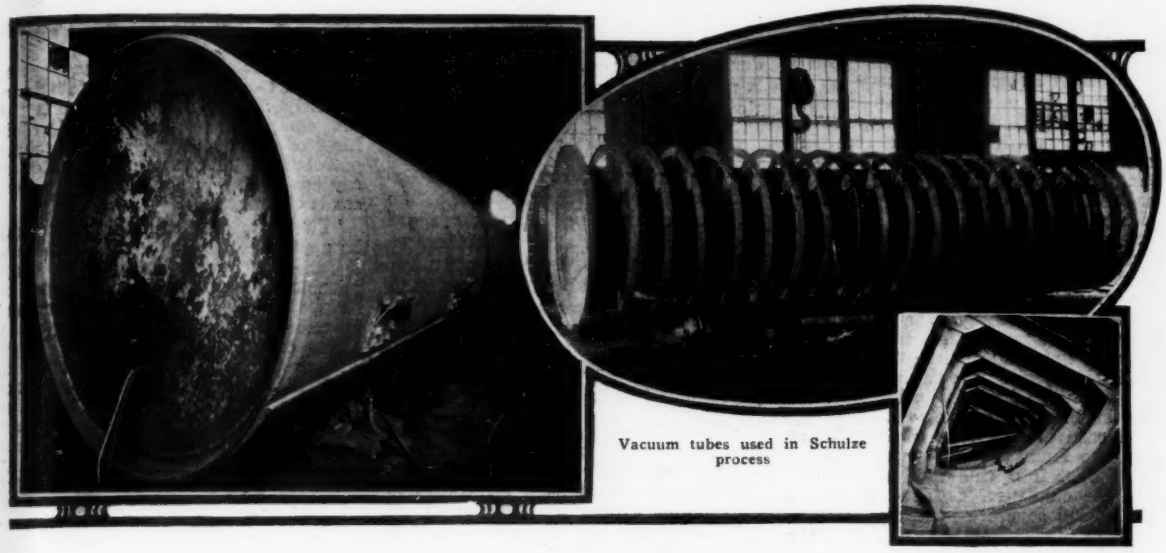


Vacuum tubes used in Schulze process

Distilling Crude Under Reduced Pressure

South Texas refiner using new process to make lube oils—Has several important features

By Grady Triplett

THE refining of lubricating oils by the Schulze process was begun in July at the Houston plant of the Deepwater Oil Refineries. The first installation of this vacuum method followed an extended period of experimentation by the inventor, John E. Schulze of Chicago, and J. P. Gillen, Deepwater Oil Refineries General Superintendent. After laboratory methods had been completed, small units were installed which have been turning out finished oils in commercial quantities for several weeks.

Distills Under Reduced Pressure

The Schulze method is one by which an oil, particularly a mineral oil, is distilled while under reduced pressure. The reduced pressure is obtained through vacuum pumps, which must apply to the whole of the equipment from still to receiving tank. Special equipment is essential. Stills for the installation at the Deepwater plant were made by the Graver Corporation on specifications furnished by the refining concern.

The outstanding value of the process, revealed in both laboratory tests and actual runs from the small unit, is that lubricants of the usual viscosities are obtained at temperatures lower than oils of corresponding viscosities are obtained under usual refining methods. To furnish such oils, the Schulze process operates without giving over with each cut, the "cracked" fractions, which necessitate the numerous purification methods employed in refining.

Process Described

The following description of the process is from the patent:

"In general, the process of the invention is characterized by distillation under reduced pressure, and particularly under an absolute pressure not exceeding about 25 millimeters of mercury as an upper limit; while distillation at very much lower pressures, say not to exceed 5 millimeters of mercury and most desirably still lower, offers advantages that are particularly noteworthy and remarkable. * * The novel process as practiced to greatest advantage also includes as an important factor, control of the distillation and determination of the successive lubricating cuts or fractions by observation of one or more physical characteristics of real significance, such as viscosity, flash point and fire point, rather than observation or gravity as has heretofore been the practice."

When properly operated, the Schulze process turns out finished oils without the usual acid treatment and washing. It is the further claim of the inventor that these untreated oils are superior in color, flash and fire to those finished under purification processes.

The Schulze process has been developed from the fact of physics that a liquid distills at temperatures, which are lower as the pressure is reduced. So the process is one of lowering pressure by vacuum, as heat is applied to the oil to be refined. Characteristics of the finished oils are the result of refining under lower temperature and reduced pressure.

Heat Optional

The process can be operated either by steam injected into the still or by the fire still, heated with gas or fuel oil. In either case an especially constructed still is essential, as it must be braced to prevent collapse, when vacuum is applied to the equipment. It is possible to construct a unit so either steam or fire may be used for distillation. This combination unit requires condensing equipment for removing the water vapor from the oil. Unless products of exceptionally fine color and sweet odor are required, steam is not used in the process.

This description of equipment for operation of the process is taken from the inventor's drawing for a unit. Practical installations, however, may vary in design. The inventory has this to say concerning equipment:

"In carrying out the process of the invention it is important that the still and associated apparatus employed therewith be of such character that the whole system can be kept under the desired low pressure clear through to and including the receiving tanks."

Whatever the type of still, it must be so braced that its walls will withstand outside pressure when vacuum is applied to the system. Both ribs and cross bars were used in construction of the stills built for the Deepwater plant. They were installed horizontal to be fired from beneath.

To prevent cracking through refluxing a baffle is set below the mouth of the vapor offtake pipe. This offtake leads to the condenser coil, inside the condenser box. The condenser coil discharges into a closed baffle box or separator, contained a series of baffles. This separator has a liquid discharge pipe at the bottom and a vapor offtake from the top.

When steam is employed in the refining, oil from the condenser boxes passes through the liquid offtake at the bottom, while the uncondensed water vapor passes through the upper pipe and into a condenser coil, which is immersed in a cooling liquid. Cooling brine under pressure is used to cool the condenser, as well as its receiving

tank, when steam is used and these are essential to the process.

Low Pressure Necessary

Vacuum for use of the process with steam is supplied by a pump, having a connection with both the receiving tank for the water vapor separator box. This pump must be capable of maintaining absolute pressure of 1 to 1.5 mm.

Steam for the process is provided through a boiler and a superheater, which force steam into the bottom of the column of oil charged into the still.

Valves are provided for leaving out the water vapor cooling system when steam is not used in the process. This applies only for a combination unit. For refining lubricating oils, fire stills may be installed exclusively.

In case of this type of installation distillate from the still passes around the baffle, into the offtake pipe and into the condenser coil and then into the baffled separator, the course identical with that of using steam. But the baffled separator plays no part of separating water vapor from oil in the fire still process. The condensed oil passes through this separator, then into the look box and then through the manifold, which is for diverting the finished oil into the desired receiving tank.

Vacuum for use with the fire still may be supplied by attaching the pump to the receiving tank and maintaining uniform low pressure by pulling against these tanks.

Special equipment is necessary for taking samples, as air must not be permitted to come in contact with the oil during the process. A series of valves is used to take samples without admitting air to the system.

How It Works

With the proper equipment and desired vacuum working the claim of the inventor is that a still may be charged and its contents heated until a sample shows the desired viscosity, when the cut can be turned into a receiving tank, to continue running there until another sample reveals the necessity for another cut, which must be turned into a receiving tank. Speaking of the running of oils by the method, the inventor says:

"For example, if it is desired to make spindle oils the first cut can be made when the distillate shows a viscosity of 100 seconds Saybolt universal (at 100 F.). The pressure in the first receiver may be released and the first cut, spindle oil, may be pumped to storage.

"The procedure is substantially the same as described for the remainder of the distillation, the pressure being maintained at around 1 to 1.5 mm. or at any rate below 5mm., for best results, and the distillate being cut for the desired fractions in accordance with the increase in viscosity as determined by the testing of samples at frequent intervals. Proceeding in this way, products aggregating 80 to 95 per cent of the volume of topped crude originally charged into the still may be obtained as straight overhead distillate."

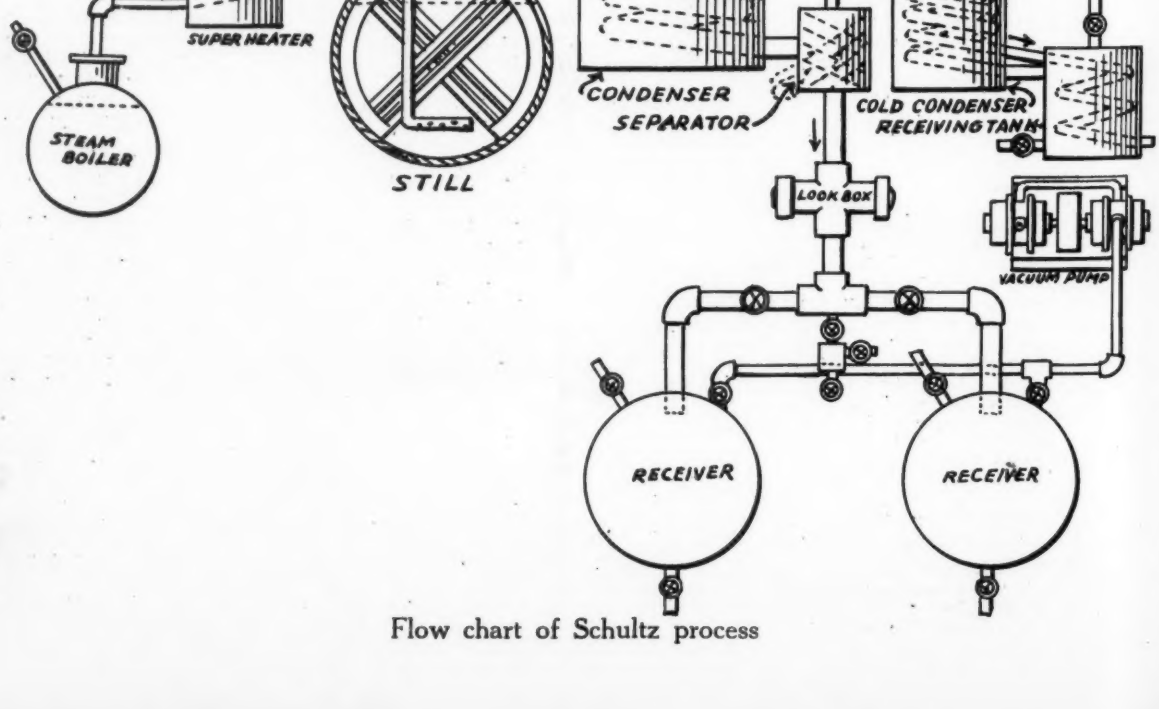
While the Schulze process "relates to the art of oil distillation," it is particularly adapted to mineral oils and the equipment as here considered is for the refining of crude and topped petroleum. The inventor has this to say concerning oils on which the process is effective:

"The process of the invention may be applied to various mineral oil starting materials. For example, it is applicable on the one hand to topped or stripped crudes of any character and is effective to produce therefrom a series of oil products markedly superior to those obtainable by the usual distillation methods. On the other hand the process can be employed with great success to treat residua that are now practically waste materials, such as still bottoms, remaining after distillation of all fractions (including lubricants) that can now be obtained by the usual distillation method, providing the particular method by which the residuum was obtained was not such as decomposed or cracked the constituents of the residuum too extensively."

If crude oil is to be used it must be topped by some method which will remove the fractions lighter than lubricants. This should be so conducted that none of the remaining hydrocarbons will be decomposed.

For Topped Oil

For handling crude oil of paraffin base the wax must be removed by



Flow chart of Schultz process

Gasoline Men Take Up Plant Problems

Regional meetings found successful in exchanging plant operating ideas and methods

By W. Lee Sloan

THROUGH its regional plant operators' meetings, the Association of Natural Gasoline Manufacturers evidently has found a method of solving those countless problems that come in the daily operation of the plants. Two such meetings, held June 28 and July 17, in two Oklahoma territories have resulted in such wide attendance that officials of the association are bent upon carrying the idea into the other sections of natural gasoline production.

June 26, the meeting was held in the Tonkawa field. July 17 the session was held at Drumright for plant men of that city, Cleveland, Shamrock, Bristow, Cushing, Oilton, Depew, Terlton, Stroud, Jennings, Yale, Meramec and Quay.

Each was a meeting of plant men, who brought their problems to the session and put them before other plant men for solution. Each session had its program, previously prepared, but each resulted in the development of topics wider than the program included.

As evidence of the interest plant superintendents, engineers and foremen take in the sessions, at the Tonkawa session they made a request that another session be held there at an early date. There were three sessions during the day and 4 men from the surrounding plants attended.

The regional plant meetings are the outgrowth of the operators' session of the last annual meeting of the association in Tulsa. So many problems resulted from this that it was decided to carry these sessions to the plants, where they have met further success.

Because of his readiness at answering questions at the Tulsa convention, Tony O'Lausen of the Chestnut & Smith Corporation was invited to the Tonkawa meeting.

Money Saving Devices

O'Lausen made a wonderful start with his talks on how a plant operator could save time and money for his employer in matters pertaining to ignition. He discussed magnetos and spark plugs at some length. It was his opinion that plant operators did not give the thought and attenion to magnetos and the other electrical equipment of the plant as was required.

Incidentally he exhibited two ways that he had evolved at Kiefer for curtailing expenditures. One was a spark plug which had been burned off at the point. With a hack saw and file segments were removed that allowed the plug to be used again for an indefinite period. The other was a device that could be attached to a circuit breaker so that it could be observed at any moment by pushing the glass to one side. By this adjustment O'Lausen said that the Kiefer plant engines ran 99.97 per cent in May and averaged better than 99 for some time.

The problem of proper lubrication for a gasoline plant was then brought up. Under the discussion it was shown that the accretion of carbon was largely due to improper lubrication. O'Lausen said that he favored injecting water into the cylinder head, through small holes that were drilled into the cylinder head and connected with the water line.

"Gas Meter Operation" was the subject of Norris Plank of the Roxana Petroleum Corporation. He explained the different types of meters used, told how they should be inspected and operated. He concluded with a description of the orifice meter, as used in the fields.

"Lubrication" was the talk assigned to Fred Corwin of the Marland Refining Company. He declared that success in the operation of a natural gasoline plant rested largely on the proper use of lubricants. Oils should be filtered and re-run, and the air chamber in the engine should also be kept clean and free from dust. Luricants of lighter viscosity were generally recommended.

The question of whether the casing-head gas in the Tonkawa contained more b. t. u. per cubic foot than in

---

some effective method before running for lubricants.

Either by topping or by procuring an oil previously topped the Schulze process requires that the starting material be such that only the several lubricating cuts be in the product charged into the still. With such starting material the claim of the inventor is that from 80 to 95 per cent of it can be converted into oils similar in viscosities to those now offered commercially, but superior to these oils in color, flash point and fire point.

Because distillation takes place at low temperatures lubricating cuts taken under the Schulze process contain scant amounts of cracked fractions. This is credited with giving the finished oils better odor, better color and to finish them so treatment by acid or other purification is not necessary.

"Quality of the finished oils is set forth in three paragraphs of the parent application as follows:

"An object of the present invention is to prevent, or at least greatly reduce, the mechanical carrying over of the oil with the vapor as above described, and, by avoiding cracking, to obviate the necessity of acid treatment, neutralization, washing and filtration.

"Another object of the invention is to produce by straight overhead distillation lubricating oils of viscosities attainable in lubricating oils heretofore only by blending cylinder stock still bottoms with lighter fractions of low viscosity and low flash and fire test.

"Still another object of the invention is to produce what can be termed narrow cut oils, particularly, lubricating oils, which are distinguishable, respectively, from comparable oils heretofore known by their relatively small range of viscosity, boiling points, and flash and fire tests, as determined by examination of initial and final fractions obtained by distilling samples under conditions precluding cracking or decomposition."

Qualities of Oil

The table given below was compiled by the inventor from laboratory tests. The three commercial grades, light, medium and heavy, of both paraffin and naphthene base were tested against similar oils run by the Schulze process. He says of the tests, "the prior oils selected for this comparison representing the best quality obtainable on the market."

The inventor describes the qualities of the oils as follows:

"The new oils are all characterized by narrow viscosity ranges that are far narrower than those found in prior oils. Oils of the novel type herein described, having viscosities up to 150 seconds Saybolt universal at 100 degrees F., show viscosity ranges as low as 50 seconds, while a range of 100 seconds is common, and a range of 250 seconds is approximately the maximum for oils of this particular class.

"Another characteristic distinguishing the present novel straight overhead non-acid-treated lubricating distillates from lubricants heretofore available commercially, practically all of which latter have viscosities up to 750 seconds (at 100 degrees F.) are acid treated, is the fact that the oils of the present invention show little or no tendency to form emulsions with water when subjected to severe emulsifying tests, but on the other hand separate from water quickly and clearly."

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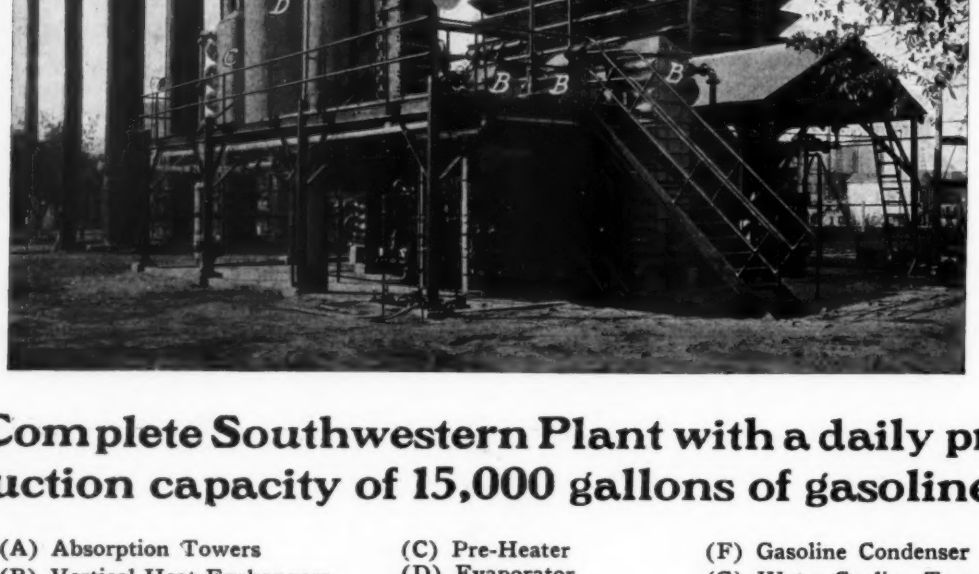

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other fields was asked by F. B. Dunlop, manager of the Bessemer Gas Engine Company, at Tulsa, but operators declared that this was not true.

Watching Leaks

A suggestion that operators pay more attention to leaks and waste and eliminate them at every opportunity was made by O. H. Schoenwald, superintendent of the McCaskey & Wentz plant. He went into details stating that a gallon of gasoline contained 15,000 drops, and if one drop a second was lost this amounted to 90,000 drops, or six gallons a day.

At noon the McCaskey & Wentz Company served a dinner at the school house, west of their plant. Following the afternoon meeting the gasoline plants of McMan Oil Company, Amerada Petroleum Corporation, Roxana Petroleum Corporation and Comar Gasoline Company were inspected.

J. R. Travis, superintendent of gasoline plants of the Lone Star Gas Company, at Dallas, and H. C. Wells, chief engineer of the Lone Star plant at Petrolia, Texas, got so much good out of the plant operators' meeting in Tulsa that they drove to Tonkawa for the session and promise to attend other plant operators' meetings in the future.

California Development in the Preparation And Use of Adsorptive Clays in Refining

By Carl J. von Bibra
Chemical Engineer

IN 1912 the great Russian petroleum chemist Gurwitsch issued his not very voluminous but exceedingly valuable book on the theory and practice of oil refining (Wissenschaftliche Grundlagen der Erdoelbearbeitung). At that time no very great strides had been made in the commercial development of adsorption processes as applied to the petroleum industry. The old established filtering methods based on the percolation of oil through a column of granular Fuller's earth were universally accepted as the only feasible way of purifying lubricating oils after or without the acid treatment. Gurwitsch, however, felt that the removal of impurities from oil by their selective adsorption in solid materials was receiving a wider and wider application. At the time he was writing his volume he commented on this fact and attempted a practical explanation of the fundamental principles of adsorptive filtration which is about as concise and generally satisfactory as anything which has ever appeared in the literature of the petroleum industry.

"Adsorption"

The term "adsorption" has only been used extensively in oil refining during the past few years. Until recently it was an expression quite familiar to the petroleum chemist, but entirely unknown to the operator. Even now it is not entirely clear just what adsorption is. We know what it does, but we are not sure as to how it does it. This is particularly true in its application to petroleum refining. We know, for instance, that when a lubricating oil of a certain color is filtered through a column of Fuller's earth of sufficient height its color will be lightened. In other words, some of the color bodies in the oil are taken up or adsorbed by the earth. The question is now why the earth took up a larger proportion of the colored constituents of the oil than it did of the uncolored ones. Also, what was the cause of the earth's taking up any constituents at all. Again, why do some filtering earths act so very differently from others. Some adsorb one type of impurities from an oil and others seem to specialize on some other type of impurity. For instance, some earths are especially valuable for the removal of color and others adsorb organic acidity to a very high degree and do not appreciably affect the color of the oil being filtered. Of course, earths which may be very effective for the selective removal of certain other constituents from oil may not be classified as filtering earths at all, if the constituent which they remove does not happen to be a so-called impurity. And so it goes. The question of determining just what adsorption is can not be briefly discussed with any satisfaction. It is a large one and as previously stated has never been conclusively answered. However, a very good conception of the generally accepted theory of the phenomenon can be gained from the explanation of Gurwitsch. The statements on theory given below are a liberal translation from his original version.

Theory of Adsorption

By adsorption is generally understood the phenomenon by which a solid body introduced into a solution removes from the latter a part of the solute. The exact mechanism of this phenomenon has been the subject of several hypotheses. At the same time it is not possible to say that it is thoroughly understood as yet. The best authenticated one is the hypothesis of Freundlich. He considers the phenomenon just defined as adsorption as a special case of the general one also called adsorption by him, and which consists therein that the free layer of a solution possesses a concentration different from that of the body of the solution. The change in concentration always, where adsorption is possible, takes place with a resulting great decrease in the surface tension. If the latter is decreased in the solvent by increase of the concentration of the dissolved substance, the latter will try to concentrate in the surface layer. This concentration in the surface layer is limited only by diffusion back into the solution ("positive adsorption"); and vice versa if the surface tension of the solvent is increased by the solute, then a decrease of concentration of solute in the surface layer takes place ("negative adsorption"). By surface layer we do not mean the ordinary one, which is a definite line between the liquid and the atmosphere, but every surface is meant which divides the solution from some other substance, either solid, liquid or gaseous. Now, if a solid body is introduced into the solution, a new surface is created, and if the surface tension of the solution at the surface of contact with the introduced substance is so influenced by the dissolved substances that it becomes smaller with the increase in concentration of the latter, then an increase in concentration of the dissolved substances will take place at the surface of contact. If the solution is removed from the solid body the layer with the high concentration of solute remains attached to the solid body. In other words, the solid body has "adsorbed" a portion of the solute, and the solution which remains behind is now less concentrated than it was originally. This, according to Freundlich, is the primary behavior of the process of adsorption, which, according to this, is not at all chemical in nature.

It is now clear that the adsorption effect, on the one hand, must be stronger the greater the surface of contact between the solution and the solid body. On the other hand, it depends on the specific influence of the foreign bodies on the changes in the surface tension of the solution. In general, a considerable adsorptive power will be found only in very finely-divided or very finely-porous bodies. But such bodies have very little effect if they happen to have only a small influence on the variation of the surface tension with the concentration of the solution. Therefore, if one has found that a certain substance has great adsorptive power in one case, there is no assurance that it will be equally effective in other cases, and it is necessary in every new case to try a variety of adsorptive materials.

The facts that there are porous substances which adsorb only weakly, despite their great amount of surface, and that one and the same substance has a different adsorptive action on various substances, can not, as some authors believe, serve as supports for a chemical theory of adsorption. They show only that adsorption has some relation to the chemical constitution of the adsorbent and of the solution which is acted on. To assume from this that we are dealing with a chemical process is just as unfair as to assume from the fact that only certain metals and metallic alloys are magnetic, that magnetism is a chemical phenomenon.

While in former years the various charcoals were prinicpally used as decolorizing materials (in the petroleum industry), their use has diminished of late and that of hydrosilicates is increasing enormously.

A thorough investigation of various sorts of Florida Fuller's earth by J. Porter Chem. Revue 1908, Nos. 10

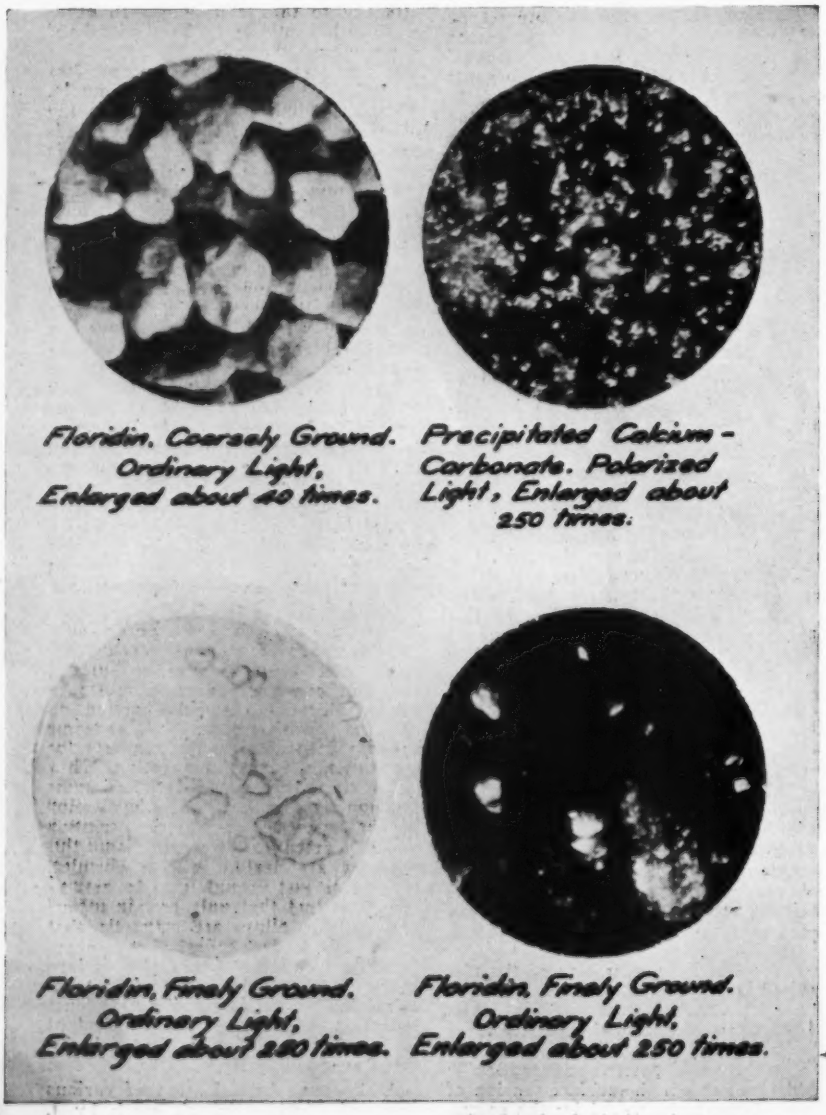
and 11.) indicated the following constitution:

Silica	from	44.0 to 72.0%
Alumina	"	5.0 to 33.0%
Ferric Oxide	"	1.2 to 15.0%
Calcium Oxide	"	0.3 to 7.4%
Magnesium Oxide	"	0.4 to 4.3%
Potassium and Sodium Oxides	"	0.4 to 8.3%
Water	"	4.3 to 25.0%

Phosphorus Pentoxide, Sulphur Trioxide, etc., small amounts.

The great adsorptive power of the hydrosilicates depends primarily on their inner structure. The microphotographs reproduced herewith are pictures of (1) coarsely ground Floridin (Fuller's earth) in ordinary light; (2) precipitated calcium carbonate in polarized light; (3) finely ground Floridin in ordinary light; and (4) finely ground Floridin in polarized light. Comparison of pictures (3) and (4) (both representing the same field) shows clearly that even the small particles of the finely ground earth are not massive, but possess a very delicate microstructure, while the amorphous substance is spotted by the tiny crystals—probably unchanged remnants of the original minerals from which the Fuller's earth was formed. The power of adsorption belongs to the amorphous part. This assumption is based on the fact that purely crystalline calcium carbonate, although its individual parts are much smaller than those of the Floridin, has a very minimal adsorptive power, at least as far as petroleum is concerned. Other very finely crystallized powders such as barium sulphate, etc., are equally useless. It can be considered certain that the inhomogeneous particles of floridin are honeycombed by innumerable microscopic and perhaps even ultramicroscopic channels which bring about an enormous increase in the adsorptive surface.

The process of adsorption during filtration of petroleum products through finely porous substances, and also the mixing method, must be pictured in the following manner: The oil brought into contact with the floridin, for instance, is taken up by the latter and the coloring matters, acids, asphaltic and bituminous substances, etc., dissolved in the naphthenes and liquid straight-chain hydrocarbons, are adsorbed promptly as soon as they come into contact with the floridin pores. In the capillary passages and intercellular spaces of the floridin there remains a clean, i. e. a very much less concentrated solvent. New molecules of the substances which are capable of being adsorbed now diffuse into these spaces from the surrounding oil, whereupon the latter, even though it does not get into the interior of the floridin particles, has its concentration of these substances reduced. The molecules which diffuse into the oil inside the particles of earth are now adsorbed, whereupon diffusion again takes place, etc., until the adsorptive power of the floridin is exhausted. The length of time necessary to reach this final state depends, on the one hand, on the nature of the floridin, that is its inner structure, as well as on the size of the particles; on the other hand, on the nature of the substance to be adsorbed as well as on the temperature. Saturation is naturally reached more rapidly the finer the adsorbent is ground, the smaller the molecules of the substance to be adsorbed, the lower the viscosity of the oil, the higher the temperature, etc.



Floridin, Coarsely Ground. Ordinary Light, Enlarged about 40 times.

Precipitated Calcium-Carbonate. Polarized Light, Enlarged about 250 times.

Floridin, Finely Ground. Ordinary Light, Enlarged about 250 times.

Floridin, Finely Ground. Ordinary Light, Enlarged about 250 times.

Recent Developments

With the foregoing theory in mind it can readily be seen why the development of adsorptive processes of oil refining was attractive. By adsorption it is possible to selectively remove from an oil practically all impurities which are removable by chemical treatments only with a large loss of valuable oil. The use of Fuller's earth has certain drawbacks. The most important of these is the very large quantity of earth required to obtain commercial results. This objection becomes a still greater consideration when suitable earth has to be hauled great distances to refining centers. For instance, it has been necessary to ship enormous quantities of Florida and Georgia Fuller's earth to California because the local earths suitable for use in granular form do not burn very well and it is therefore economical to bring in the earth from the Atlantic seaboard. Another disadvantage of Fuller's earth is the relatively large amount of good oil retained by the material. This oil can only be recovered at a considerable loss in quality and therefore in value. The loss from this source is, in many cases, less than the loss which would be suffered if all the purification had been attempted by acid and soda treatment of the oil, but it is nevertheless a large item. Therefore the development of a filtering material of higher potency would be valuable in that less of it would be required to treat a given amount of oil and therefore less oil would remain entrained.

This is exactly the trend which the development of adsorption processes in California took. Several years ago the technical journals of the country all conveyed the highly interesting news that one of the very large California oil companies had acquired extensive deposits of clay in Death Valley. This clay, when treated by a not very well understood process, was reported to yield a filtrating material having five times the efficiency of Florida Fuller's

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earth. A little later other deposits were discovered in various parts of California and Nevada. The clays contained in these deposits were not identical with the Death Valley Clay. They did, however, have one characteristic in common which was that when treated with dilute mineral acid they became valuable filtering maacid they became valuable filtering materials. Their efficiency ranged from two and one-half to 20 times that of a standard grade of high class Fuller's earth when the two materials were applied to the same oil under identical conditions.

None of the filtering clays above mentioned were used in granular form. All had to be used as powders. This naturally entailed the remodeling of refining methods and apparatus. This has been discussed in a previous article. We are here interested not in the manner of application of these clays, but in their occurence and method of preparation for use.

Incidentally, as is well known, treated clays are not the only high grade adsorptive materials at present proposed or used in oil refining. Silica gel, a purely artificial product, has been well developed technically and highly advertised. Its ultimate value to the refining industry has yet to be proved despite the fact that it is apparently receiving favorable attention in connection with certain limited applications such as the treatment of refractory kerosene and gasolines.

During the past year considerable deposits of a very highly effective natural filtering clay have been discovered in California. Just to what extent this clay will displace treated clays still remains to be seen. It is peculiarly adapted to the neutralization as well as the decolorization of lubricating oils and has very interesting possibilities.

Treated Clays

There are a great many clays and earths which, when treated with acid and subsequently washed with water, produce a material which can be used effectively in the filtering of oils. Most of these clays and earths, however, are not uniform in composition or else have other characteristics which render them unreliable for treating purposes. The acid treatment of clay is an expensive operation and it is consequently absolutely necessary to work on a raw material which will give uniform results. To obtain a finished material from one batch which has an efficiency of 6 as compared with Fuller's earth and then from the very next batch, handled as far as can be determined in exactly the same manner as the previous one, obtain a finished filtering material with an efficiency of 1.5 or 2 is not only decidedly discouraging, but economically unsound.

There are three deposits in California which are being exploited at present which contain large quantities of relatively uniform clay. These deposits are all reasonably accessible to rail transportation and one of them is very close to tidewater. The latter is the Montmorillonite deposit underlying the Otay Mesa in San Diego County. The other two deposits are in the Mojave Desert, in the Death Valley region.

These clays are colloidal in nature. The one here named Montmorillonite has also been classified by various writers as Bentonite, Otaylite (the local name), Mountain Soap or Saponite, etc. The other clays are locally classified as Halloysite.

Montmorillonite is so named because of its close resemblance to a mineral found years ago in the neighborhood of Montmorillon, France. None of the French mineral is available now for examination as the two known outcrops have been sealed up behind structural stonework. The mineral as found in California is dense and relatively hard. It has a feel very similar to a hard soap with which very finely ground pumice has been mixed. In consistency it is waxlike when freshly mined. It contains approximately 50 per cent water and shrinks rapidly upon exposure. Upon shrinking it cracks and breaks up into small fragments. Upon long exposure to sun and air it crumples and dries until the total mass does not look unlike a pile of decomposed granite as commercially supplied for road-making purposes. The Montmorillonite of San Diego County, California, occurs in a practically level stratum varying in thickness from three to seven feet. In all probability, according to Paul W. Prutzman, who is more thoroughly familiar with the mineral than anyone else because of his painstaking and very thorough research on the subject, this Montmorillonite is not a true clay, but is rather an altered volcanic ash laid down in an ancient sea bed whose bottom was already deeply covered with widely varying deposits in many strata. The Otay Mesa, which the mineral underlies, is deeply eroded. It is therefore possible to economically mine the Montmorillonite by open cutting for distances of 30 to several hundred feet from the canyon walls. It is only recently that one of the oil companies has resorted to tunneling. The reason for this is not that there is not an ample quantity of the mineral available for open cutting, but rather that the company in question has developed a very convenient drying floor in the large area which has already been cut away. It is therefore anxious to avail itself of this level floor for the drying of a large quantity of the mineral which has to be mined this summer. Incidentally, it is practically impossible to mine Montmorillonite during the rainy season unless all operations are carried on under cover. This is because the raw mineral forms a slippery, slimy and homogeneous mass when wet. It is practically impossible to handle such a mass without considerable special equipment which would not be economically warranted.

Montmorillonite is found throughout the Otay Mesa in remarkably uniform quality. Incidentally the deposit extends for an undetermined number of miles into Mexico. Because of the large available supplies in California the extent of the Mexican deposits has never been investigated, so far as is known. One curious thing about the mineral is the variety of colors in which it occurs. These shades vary from white to chocolate brown and from pink to green. The color variation is apparently due to the admixture of minute quantities of mineral pigments, the quantity of these pigments being so small that they are not determinable by quantitative analysis, except as traces.

Below are given analyses of three typical samples of San Diego Montmorillonite. The uniformity of the samples is readily apparent.

Clay Number	1	2	3
Loss on ignition (including moisture)	12.5 %	12.27%	12.96%
Moisture at 110°C.	5.3	6.46	6.48
Analysis on Moisture Free Basis at 110°C.			
Silicon Dioxide SiO_2	61.24	61.75	63.94
Aluminum Trioxide Al_2O_3	17.16	17.84	18.27
Ferric Oxide Fe_2O_3	2.43	1.13	1.41
Titanic Oxide TiO_2	.53	.51	.21
Calcium Oxide CaO	1.77	1.76	1.03
Magnesium Oxide MgO	7.07	6.99	7.92
Sodium Oxide Na_2O	2.02	1.55	2.12
Potassium Oxide K_2O	.66	.95	.21
Chlorine Cl	2.25	2.14	1.88
Sulphur Trioxide SO_3	.96	.36	.21
Carbon Dioxide CO_2	.34	.43	trace

Upon treatment all the clay, no matter what its color when raw, yields a filtering material of uniform value. In a measure this is also true of the mineral Halloysite, but not to the same extent as Montmorillonite. Another difficulty is met with in the handling of Halloysite. This is the fact that the mineral is not found in as large or as uniform deposits as Montmorillonite. To be sure, the deposits of the former are large enough for commercial exploitation. In fact, two of them have been worked for a number of years. However, judging again from Prutzman's investigations, Halloysite seems to have been formed by the action of mineral springs and therefore occurs in lenses of relatively small tonnage instead of in one enormous stratum.

Victor H. Smith, vice president and general manager and Fred H. Thwing treasurer of the Lion Oil Refining Company of El Dorado, Arkansas. The company is operating one of the most modern refineries in the country.

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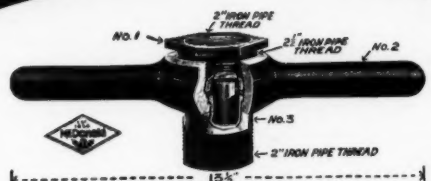

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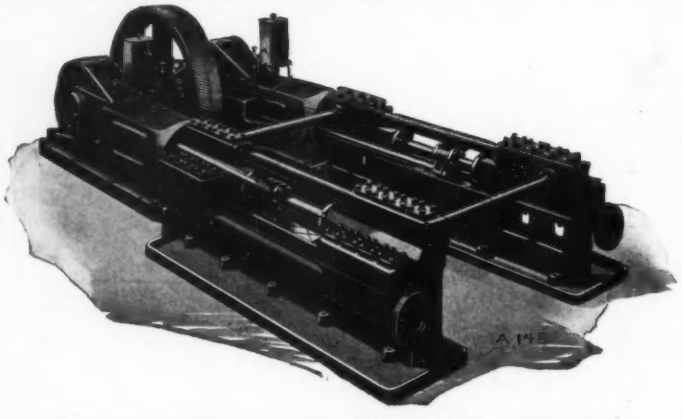

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This lenticular formation makes mining more difficult. Further, upon treatment Halloysite yields a material which is somewhat inferior to Montmorillonite in efficiency. The raw Halloysite, incidentally, is a very light, soft and snow white mineral.

Clay Treating Methods

The method adopted by several clay manufacturers and refining companies for the treatment of clays naturally vary considerably. Each interest had to work out its own technique and in addition there are various differences between the clays from the various deposits.

The methods adopted by several clay of non-adsorptive clays for the manufacture of highly adsorptive filtering materials are the following:

The raw sun-dried clay is ground to about 100 mesh. It is then gradually fed into a solution of sulfuric acid of approximately 25 per cent strength. This operation is carried out preferably in leadlined agitators very similar to those used in oil treating. Here the mixture is cooked with live steam. After the reaction is complete the treated clay is washed free from aluminum sulphate and other soluble salts by the action of the acid on the clay. This washing is usually accomplished in separate vessels, the acid-treated clay being transferred to these wash vessels by pump after having been diluted with water. The clay is washed several times with successiveamounts of water, either hot or cold. The number of washes depends both on the character of the clay being treated and on the type of finished material which it is desired to prepare. For the filtration of certain types of oil a clay is required which is more acid than would be used for other oils. This is a matter which each refiner must determine for himself.

After the washing is complete the clay can be handled in one of several ways. One of the California refining companies has developed a process for the use of clay in the form of a thin mud. This thin mud is mixed directly with the acid-treated oil after the suspended tar has been knocked down. The mixture of mud and oil is then emulsified and dehydrated in a tube furnace, the adsorptive action of the clay on the oil taking place simultaneously. This is a patented process. Another way of handling the clay after the completion of the washing operation is to remove most of the water by passing the mud over a leaf filter. The resulting moist cake is then dried and ground to about 200 mesh. This powder is then ready for use.

Recovery of Spent Clay

Finely divided clay, whether natural or treated, may be recovered by several processes. The recovered clay has not, however, the high adsorptive power of the fresh material. Experience has shown that treated clays having an efficiency of four to six times that of representative Fuller's earth yield a recovered material with an efficiency of one or even less. A better grade of recovered material can be produced by the application of elaborate solvent processes involving the use of several more or less expensive organic sol-

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STEEL

vents. This procedue is, however, not feasible commercially.

One of the simplest and most generally satisfactory methods of disposing of spent clay filter cake is to burn it under boilers or stills equipped with dust collectors. In this way the slimy cake, which is pretty much of a nuisance around an oil refinery, is disposed of and a recovered clay is obtained which can be used to good advantage in many operations such as the decolorizing of gasoline, for instance.

Another recovery operation which is warranted when operating on a considerable scale is the leaching of the filter cake with a heavy naphtha kerosene distillate. In this way much of the lubricating oil is recovered in reasonably good condition and the cake can finally be burned as outlined above.

Economic Aspects

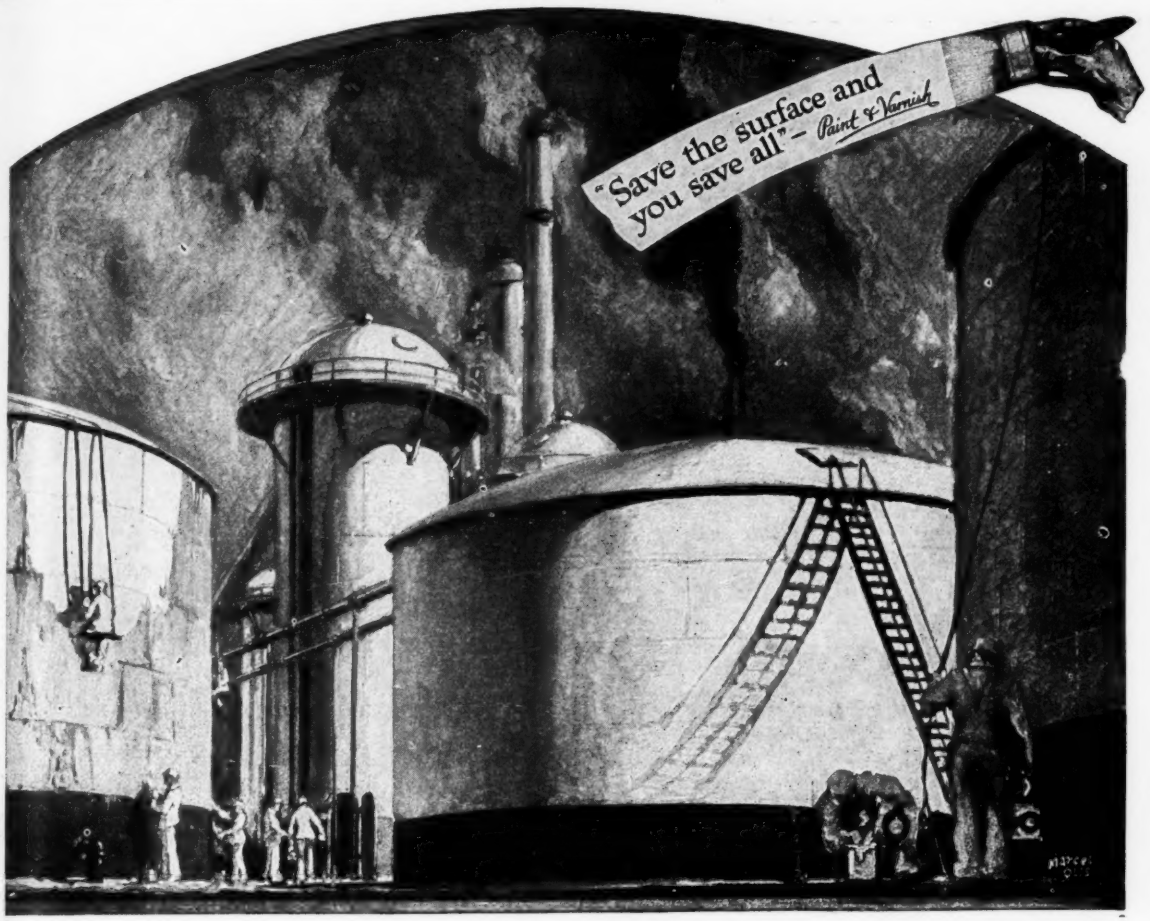
The mining of colloidal clays and the manufacture of high grade filtering materials is a new development on the Pacific Coast. So far as the writer knows nothing of this kind has ever been attempted elsewhere. The acid treatment of filtering materials such as the Fuller's earths for the purpose of enhancing their filtering power is, of course, a well known process. But the production of a highly adsorptive material from a complex natural mineral is apparently something new. It is closely related to the production of materials like silica gel, which are entirely artificial and very expensive, even when compared with the California treated clays.

The mining, manufacture and distribution of filtering clays has become a new industry. At the present time most of the substantial operations are being carried on by big refining companies. However, there are two concerns in the field which are specializing solely on the handling of these clays. There is much pioneering still to be done. The use of the material generally involves the remodeling of present treating equipment by any oil company adopting the new methods. Nevertheless, results have been shown and the acceptance of any new method of operation is a cumulative matter. After a few representative companies have made exceptional profits others competing in the same territory must follow.

What has been demonstrated so far may be summarized as follows:

(1) Too little attention has been paid in the past by refiners to the adsorptive power of the filtering materials which they have been using. It pays to get a material having the very highest effectiveness. If this is not done the refiner pays freight on a large quantity of material to do work which can be done by a much smaller quantity. For instance Pacific Coast refiners had been bringing Fuller's earth all the way across the continent to accomplish results which can now be accomplished by the use of a locally prepared material having one-third to one-twentieth the volume for unit work done.

(2) It is now possible to cut treating losses and treating costs generally by the elimination of chemical neutralization, water washing and air blow-



Cut Down Your Evaporation Losses With Cook's Gas-Proof White

Cut your painting costs and your evaporation losses at the same time. Painting light oil storage tanks for protection against losses is an economic necessity. At the same time you can cut your painting costs if you will use

Cook's Gas-Proof White

"known and used all over the oil fields"

Cook's Gas-Proof White has practically the same degree of light reflection as the most expensive metal paints and is exceptionally efficient in preventing evaporation losses.

For the greatest protection, economy and satisfaction, use Cook's Gas-Proof White for storage tanks.

Write us for Paint Circular No. 131 on "Paints for Light Oil Storage Tanks," put out by the Paint Manufacturers Association of the U. S.

Rise in Temperature of Benzine Contained in Small Tanks Painted in Various Colors (Gloss Finish), when Subjected to Rays of Carbon Arc for Period of Fifteen Minutes.

Color	Rise in Degrees Fahrenheit.
Tin Plate	19.8
Aluminum Paint	20.5
White Paint	22.5
Light Cream Paint	23.0
Light Pink Paint	23.7
Light Blue Paint	24.3
Light Gray Paint	26.3
Light Green Paint	26.6
Red Iron Oxide Paint	29.7
Dark Prussian Blue Paint	36.7
Dark Chrome Green Paint	39.9
Black Paint	54.0

Effect of Color on Temperature and Rate of Volatilization of Naphtha in Metal Tanks.

Color of Tank	Temperature of Naphtha, Degrees F.	Percentage Loss of Naphtha by Volatilization
Black	111	9
Bright Red	109	8
Dark Red	108	8
Dark Green	108	8
Battleship Gray	106	6
Tan	104	5
Red Primer—White Top Coat	102	5
Cream	102	5
Pale Blue	102	5
White	100	4

From Circular 44, Paint Manufacturers' Association.

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Especially adapted for use in the Cracking Processes

GUARANTEED ACID PROOF AND CORROSION PROOF

GUARANTEED NON-CONTAMINATING AND NON-ABSORBENT

Figure 134

Small Tube, or Ring, Tower Packing

One size only shown in illustration but are made in the sizes listed below, or any size you may desire, in either glazed or unglazed body as preferred.

Sizes	Per Cu. Ft.	Wt. Cu. Ft.
⅝" lg., ⅝" dia., ⅜" hole	3200	60 lbs.
¾" lg., ¾" dia., ½" hole	2800	57 lbs.
1 " lg., 1 " dia., ⅝" hole	1200	57½ lbs.
1¼" lg., 1¼" dia., ¾" hole	700	50 lbs.
1½" lg., 1½" dia., 1 " hole	500	45 lbs.

Packed in barrels for L.C.L. shipment or loose for carload shipments. Specify if wanted in glazed or unglazed body, also quantity and size. Samples gladly furnished.

Write for fully illustrated and descriptive catalogue on Acid Proof Chemical Stoneware

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ing; all of which is accomplished by the use of highly adsorptive mudded or powdered clays.

(3) There is absoluely no danger of running short of readily accessible raw material. Vast quantities are within easy reach of present transportation facilities.

Possible Effect from Government Suit

(Continued from Page 9)

posing itself, were it to attack validity of the patents, as another branch of the government allowed them. Allowing the patents brought a muddle. The patent holders sought a solution in agreements and licenses, which now have been attacked as a combination in restraint of trade.

But this action can not be accepted as an effort to clarify the muddled situation of the several patents. It seems to be one merely to nullify agreements and license contracts, leaving the patent muddle as it was and the oil industry and the general public deprived of the benefits of cracking.

Allegations of combination, conspiracy and monopoly are based on the agreements between the patent holders, as well as the license contracts between patent holders and process users. That there are agreements and contracts is well known, for no effort has been made to conceal them. But one branch of the government allowed patents, on processes, and the only avenue for permitting their wide use was by license and contracts had to be made, if royalties were to be paid.

The agreements and contracts carry so many provisions that it is impossible to list or classify them. That they involve manufacture, sale and transportation of gasoline from cracked distillates is a matter of common knowledge. Whether these conditions are in violation of the Sherman anti-trust law is the point in question.

Against the users of the processes, this allegation is made: that the licensees have become a part of the combination by agreeing not to bring action to test the validity of the patent, while enjoying its benefits.

Novel Use of Old Law

While this may be a novel method of reaching the desired result, that principle is old in law. The statutes of the several states do not permit the lessee of a building or a piece of real estate to take action to acquire its possession by law, while it is leasing the property. Such statutes require that a man to gain possession, must begin from the outside, making it unlawful for him to get possession before striving to acquire title.

It is interesting to speculate on the effect, should the suit be won in every point for the government. One result would be the abrogation of all contracts, by which users hold manufacturing licenses. So royalty payments would cease, leaving the present licensees in possession of their equipment with no obligation to pay royalty on products run through it. It is doubtful if patent holders ever could recover anything under this condition.

But patent holders would be forced to take legal action to determine their rights, after contracts and agreements had been left void. Injunctions would halt the greater part of all cracking

Use of Hypochlorite Solution Finds Favor

Process of de-sulphurization used on Persian crudes can be utilized with only few changes

By Lincoln T. Bradley

IT HAS remained for the rich Persian crude oils to add another interesting chapter to their history of modification of oil refining practices. This time these crudes are credited with having been responsible for the development of a new process used in the refining of crude oil, which is said to show evidence of one of the most far-reaching in modern refining practice.

Hypochlorite Method

The process referred to is the refining of petroleum distillates by the hypochlorite method. White this is not entirely new in theory, its successful application on a commercial scale is only comparatively recent. At present it is being taken up on a large scale by several of the larger American refining companies, having been proved successful in foreign countries.

The Anglo-Persian Oil Company, Ltd., of Great Britain, having to deal with a Persian crude oil of high sulphur content, developed and patented the hypochlorite process as the best known method of de-sulphurizing and eliminating all other compounds causing development of corrosive properties, color and bad odor. This process now is in successful use at this company's refineries at Llandarcy, South Wales, and Abadan, Persia. Information is that it has shown many marked advantages over the widely used acid alkali treatment. It is used in refining products for the European trade, where many demands are more exacting in specifications in this country.

Leaves No Sludge

The hypochlorite of lime solution is made at the refiner's plant from liquid chlorine and hydrated lime. The solution is easier to handle from a mechanical standpoint and does not leave the residual sludge of the sulphuric acid treatment, thus eliminating a serious difficulty of modern refiners. One chief advantage claimed for the new process is that it produces gasoline of a higher quality, while permitting the refinery to show a lower operating cost.

Within the last few years liquid chlorine has become a standard bulk commodity of many chemical-consuming industries. Thousands of tons are used every year for the bleaching of paper-pulp and textile materials, for the purification of water supplies, and for the manufacture of numerous important chemicals. The many improvements effected in the methods of liquefying, transporting and applying the gas have rendered its use easy, safe and inexpensive.

In refineries using the batch method of treating the crude distillate about the only change involved in adopting the hypochlorite process is the replacement of sulphuric acid by the hypochlorite of lime solution. Where continuous treatment is employed some modification in the order of solutions is said to be desirable, without important equipment changes. Experience is said to have shown that ordinary steel apparatus can be used, since the corrosion of apparatus, piping and similar equipment is much less with hypochlorite of lime.

Following Operation

According to the usage of engineers of large chemical establishments, refining under the new process is carried or as follows. The first step is the preliminary caustic wash, using a solution of from 8-14 degrees Baume or 12-21 degrees Twaddell. The volume of the caustic solution should be not less than 3 percent of the volume of the distillate treated, in order to insure proper mixing.

The caustic solution is made up either by dissolving solid caustic in water or by diluting liquid caustic soda to proper strength. The solution is pumped into the agitator at the top and spread over the surface of the distillate by means of a suitable distributing device. It then sinks through the distillate and as it settles to the bottom of the agitator it is pumped to the top again. The time required for this operation depends upon the efficiency of the circulation and under proper conditions should take from 15 to 20 minutes. The caustic solution is then returned to the supply tank and regenerated by blowing steam through it and the addition of fresh caustic. It is claimed that this preliminary caustic wash improves the odor of the distillate and removes some of the color.

When the preliminary caustic treatment is used it should be followed by a water wash to remove traces of caustic trapped by the distillate. In the subsequent hypochlorite treatment this caustic would react with the hypochlorite and create lime, which might cause an emulsion to form between the hypochlorite and the distillate. The water is introduced and circulated in the same way as the caustic solution or in some cases a special distributor for water only is used and the water run to waste at the bottom of the agitator.

Proportion Varies

The proportion of hypochlorite solution required for a batch of distillate varies with the strength of the solution used, the average composition of the distillate and the degree to which it is desired to carry the refining. For straight-run distillates the strength of the hypochlorite solution can vary between 20 and 30 grams per liter of available chlorine, while for cracked distillate better results have been ob-

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stills. If these stills are capable of increasing the recoverable gasoline from a barrel of crude oil by two and one-half times, then the drop in gasoline output, incident to the inactivity of the stills, would undoubtedly run the price of gasoline to a figure which would bring a wail from the public, with its corresponding outcry from the politicians and then perhaps an investigation.

It is possible that trial of the suit will result only in removal of territorial restrictions now part of the license contracts. With that determined, licensees could continue using their equipment, paying prescribed royalties but selling their output regardless of state lines. It would seem that this part of the action has more merit than any other.

But in regard to territorial rights, it is noticeable, that no concern has been instrumental in driving another from a territory. By contracts agreed to, one concern has given up its sales rights in a certain territory for the privilege of enjoying the benefits of a certain manufacturing process.

Neither has the matter of prices ever occurred in the many contracts cited in the petition, as evidence of combination in restraint of trade.

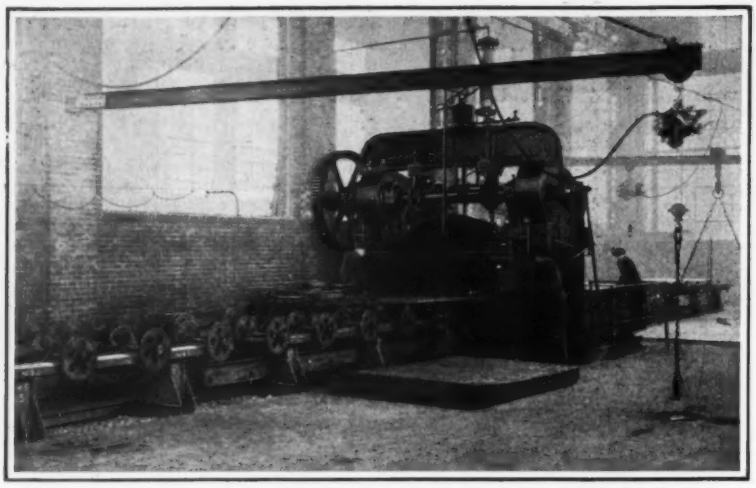
The contracts of license have all the marks of straight business propositions. With several cracking processes from which to pick, the refiners have studied the conditions of each and evidently have selected that which offered the better opportunities for profit.

That the contracts thus signed, carried conditions of sale and transportation of gasoline, was due to the fact that the patent holder had a process from which he must receive a royalty, something allowed by a patent. Manufacturing and sales restrictions were his only means of assuring this return, as the product itself could not be patented.

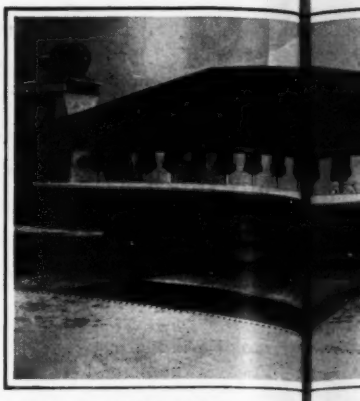
The petition has a singular condition in that it lists the several defendants by two classes, "Primary defendants," those owning the cracking processes; and "secondary defendants," those using the process by license.

The folly of the whole action, although allegations of the petition may be upheld in all courts, is that it offers no solution of the muddle of patents on cracking processes. That this condition came about, with the approval of the patent office, has long been known to the leaders of the refining industry.

Perhaps it would have been a wiser, if not quicker way, had the various patent holders established their claims through the courts instead of adopting agreements and licenses to give cracking more general use. The action pending in Chicago certainly is no effort to clarify the cracking muddle. If the government wins on every point, it will leave the cracking situation in even more complicated state than when agreements were made between the process holders, leaving them to determine their status in the courts.

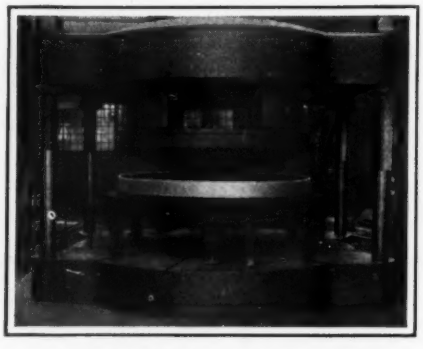


This big Multiple Punch and Automatic Spacing Table is typical of the equipment which enables Biggs to handle the big job promptly and well. The machine is set and the entire width of the sheet is punched *accurately* in a single operation.



This large Plate Planer is a to equipp successfully produce the heavie plate c similar equipment. This machin nes the

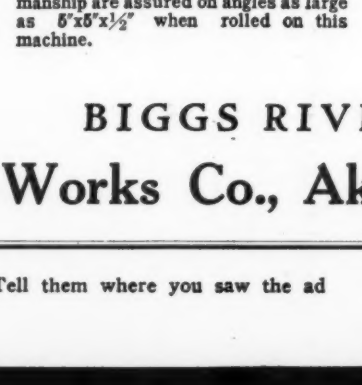
In this oil burning furnace the circular plates which are to form the heads of tanks or cylinders are heated to a cherry-red, preparatory to being flanged and dished.



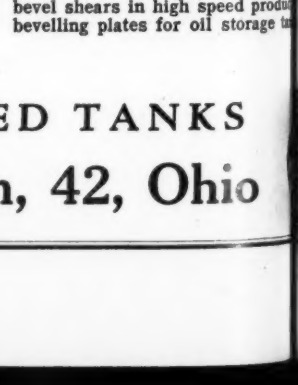
Under 300 tons hydraulic pressure heads as large as 9 feet diameter and as thick as your two fingers are flanged and dished at one operation. An extra deep flange for double riveting is easily obtainable on this press.

Here is a close- ur six This "Bull" has ch gap sure of 150 tons ts 1½ Biggs methods, w ment, the slogan "Made s Tight

A 300-ton Hydraulic Scarfing Press insures perfect scarfing edge on all plates, regardless of thickness.



Uniform accuracy and perfect workmanship are assured on angles as large as 5"x5"x½" when rolled on this machine.

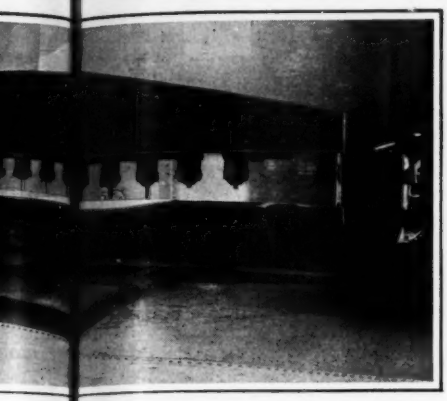


Section of tank shop showing one bevel shears in high speed produ bevelling plates for oil storage t

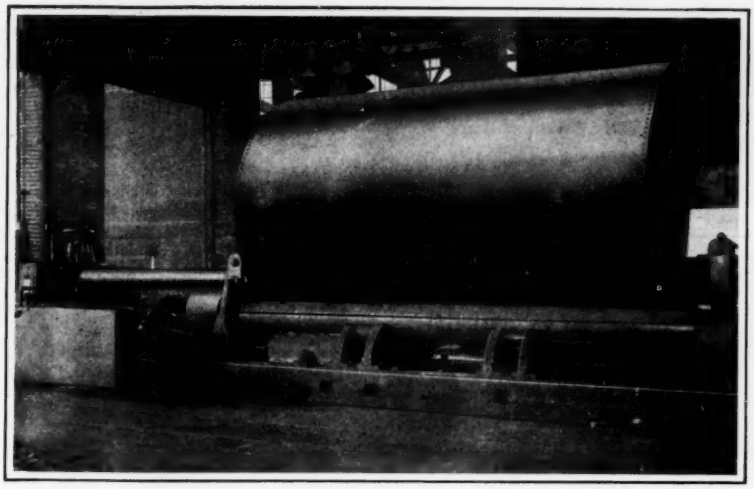
Our well in w final

BIGGS RIVETED TANKS

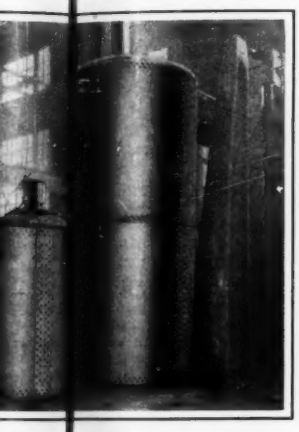
The Biggs Boiler Works Co., Akron, 42, Ohio



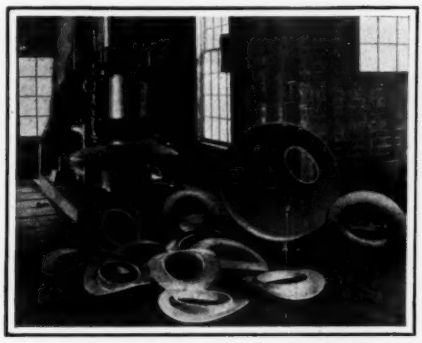
r is a to equipped tank plant can do without and he heavie plate construction such as oil stills and is machi nes the edge of the heaviest plate.



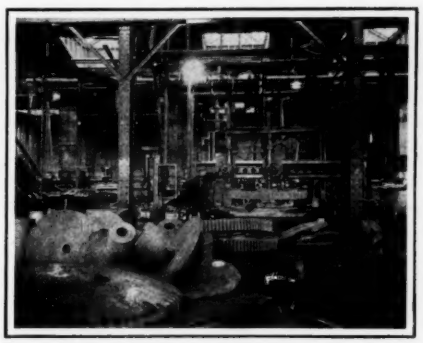
The Plate Bending Roll pictured above takes a big sheet of steel plate from a half-inch to an inch and a quarter in thickness and forms it cold into the proper shape for a huge cylinder shell.



a close-t ur six hydraulic riveters. Bull" has ch gap and exerts a pres- 150 tons ts 1½ inch in diameter. ethods, w ment, are responsible for an "Made s Tight."

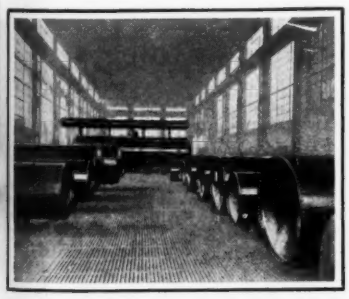


On the 250-ton sectional flanging press shown above, by using variously shaped dies, we can form a limitless variety of shapes and sizes. Some of these are suggested by the finished pieces in front of the press.

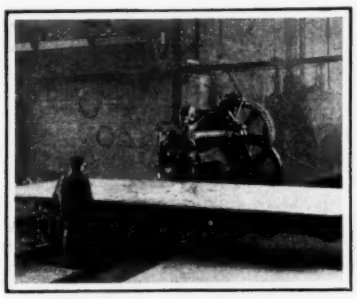


In the foreground you see an assortment of journals and gear castings for rotary boilers used in paper mills, ready to be machined. In the background is a 105-tooth spur gear being turned out on a 10-foot boring mill.

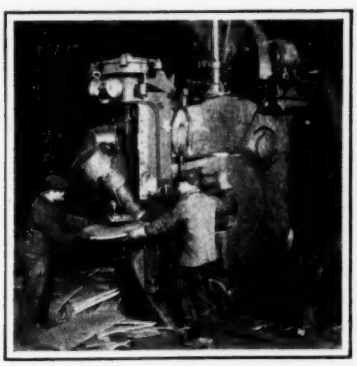
ving one o ed produc storage ta



Our test block is an entire building well lighted and thoroughly equipped, in which all Biggs products receive their final inspection and hydrostatic test.



Heavy-duty single punch with one man spacing table. Our punching equipment includes various capacities up to 1½ inch diameter holes.



This heavy-duty No. 6 Quick-Work Shear does quick and accurate straight shearing as well as circle and serpentine cutting.

S io

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Steel Plate-Refinery and Field Storage Equipment

tained, it is reported, with weaker solutions. The hypochlorite is intimately admixed with the distillate. Depending on efficiency of circulation, the treatment usually takes about 30 minutes. When the agitation is completed the hypochlorite solution has been decomposed to a dilute solution of calcium chloride and this spent liquor is run to waste.

The hypochlorite treatment is followed by a second water wash, a second caustic wash and a final water wash. These are conducted in about the same manner, the solutions being drawn off and regenerated as before.

This completes the refining process in case the gasoline or kerosene fraction has been treated. If a "benzene" has been treated the distillate must be returned to the stills for a re-run for the proper fraction.

The steps in hypochlorite refining by continuous method are identical with those of the batch method, except in manner of carrying out successive treatment. In the continuous method the distillate is pumped through the system at a predetermined constant rate of flow and the refining agents are allowed to react with the distillate by passing the two solutions together through a suitable mixing device.

Of course this method of treatment is not strictly continuous as operations must be shut down occasionally to replace spent caustic solutions. In the Mathieson process the flow of hypochlorite is metered and so controlled that it is just sufficient to refine the flow of distillate to the desired degree and at the same time entirely use up the content of available chlorine. The spent liquor then will have exhausted its refining value and can be run to waste.

It long has been established that sulphur compounds occurring in petroleum products are objectionable and are largely responsible which refining seeks to remove. This is particularly true of gasoline and kerosene, in which sulphur compounds cause instability as a usual thing, and also offensive odor and corrosiveness of metal. In some cases these properties are not apparent immediately upon refining, but develop in storage later. It is claimed for the hypochlorite process that it improves the odor and removes such sulphurous compounds as develop color and bad odor while gasoline and kerosene are in storage. It appears to be available for all types of crude oil.

Refining by hypochlorite may be carried out according to either of two principles: (1) complete desulphurization, or (2) refining to pass the usual tests and be satisfactory for color, odor and keeping qualities. The latter method requires much less of the reagent and is more economical. The distillate, it is said, may usually be made entirely sweet in odor and negative to the copper corrosion and Doctor tests without actually removing all the sulphur present.

The amount of hypochlorite required to refine gasoline distillate from crudes vary. According to information based on recent tests, a good quality of crude gasoline distillate may be refined to pass the corrosion and Doctor tests with two or three pounds of chlorine in the form of hypochlorite per 1000 gallons, but complete desulphurization of a gasoline such as that from the Persian crude referred to above requires as much as one pound per 50 gallons.

In the case of absorption gasoline, from natural gas, it has been the custom to refine only by scrubbing with alkalite plumbite or "Doctor" solution. It is customary to add sulphur to cause the resulting mixture to "break" and settle properly. This, while making a gasoline sweet to the "Doctor" test, is said to make it quite corrosive to copper. This is said to be overcome by the use of the hypochlorite.

With Cracked Gasoline

It is known that treatment of cracked gasoline with sulphuric acid may introduce esters of acid which are not entirely removed by the alkali wash and which are decomposed during redistillation, ofter causing corrosion of stills and condenser equipment. Acid refining of cracked gasoline also causes a large proportion of the unsaturated hydrocarbons to be polymerized to higher boiling hydrocarbons, which raise the "end-point" of the gasoline and which are removed by redistillation. Chemical treatment losses by the acid method vary from about 1.5 per cent upward depending upon the quality of distillate and the amount of acid required. Losses by the hypochlorite process are said to vary from one-fourth to one-half per cent.

Liquid chlorine was first shipped in tank cars during the world war when the moving of large quantities for war purposes made necessary the use of units of a capacity previously considered hazardous. Shipment in these cars carrying 15 tons of liquid chloride in one unit was continued after the war, when new and extensive markets were opened up.

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mpire Gasoline Co., Bartlesville—			Sapulpa, (Frisco)	*	600
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Tallant, (MV)	†	10,000	Beggs, (Frisco)	†	3,000
nfisco Oil Corp., Tulsa—			Livingston Oil Corp., Tulsa—		
Glenpool, (2), (Frisco)	*	3,000	Bixby, (MV)	†	500
esher Pet. Co., Tulsa—			Bristow, (Frisco)	†	5,000
Sperry, (MV)	†	500	Magnolia Pet. Co., Dallas—		
ster & Norwood, Bartlesville—			Bartlett, (KO&G)	*	500
Barnsdall, (MV-MK&T)	†	2,500	Cushing, (St.Fe)	*	2,250
ster & Davis, Bartlesville—			Deware, (MK&T)	*	400
Osage, (MV)	†	500	Duncan, (Rk.Is.)	†	2,500
ur Gasoline Co., Tulsa—			Healdton (5), (ONM&P)	*	6,000
Bixby, (MV)	*	1,000	Quay (2), (MK&T-St.Fe)	*	6,500
anchot & Co., Tulsa—			Oilton (3), (St.Fe)	‡	7,300
Keifer, (Frisco)	*	800	Shamrock (5), (Frisco-St.Fe)	‡	20,000
tes Oil Co., Ardmore—			Yale, (MK&T-St. Fe)	*	6,000
Healdton, (St. Fe)	*	2,000	Marland Refg. Co., Ponca City—		
lliland Oil Co., Tulsa—			Ponca City, (St.Fe)	*	3,250
Barnsdall, (MV)	*	600	Ponca City, (St.Fe)	†	2,500
Drumright, (St. Fe)	*	700	Ponca City, (St.Fe)	§	1,100
Oilton, (St. Fe)	*	600	Mervine, (St.Fe)	*	6,000

Putting Old Greenville Plant in Shape to Work

Greenville, Texas.—After standing idle more than three years the 2000-barrel daily capacity skimming plant formerly operated here by the North Texas Oil and Refining Company, Ltd., has been acquired by the National Refining Company of Texas and is to be placed in operation shortly. J. W. Mettler is the plant superintendent in charge of the repair work now taking place around the plant, and cracking equipment is to be added to handle Luling and Corsicana-Powell crudes.

Installing Cracking Unit In Rocky Mountain Plant

Casper, Wyo.—Materials for the construction of a cracking unit at the White Eagle Oil and Refining Company's refinery near this city began arriving early this month. The Holmes-Manley cracking process, which is owned by The Texas Company, is to be used, and the single unit will have a charging capacity of 1000 barrels daily. White Eagle is making use of this cracking process at its refinery near Fort Worth, Texas. The Casper plant was placed in operation last February, and is running about 4000 barrels of crude daily.

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stallation within a year of duplicate 160 h. p. Reeves gas engine compressor units by a large eastern gas company.

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Transcontinental Adding To Fort Worth Refinery

Fort Worth, Texas.—A new battery of six fire stills are being added to the Transcontinental Oil Company's refinery and lube plant near Fort Worth, and the new equipment is to be ready for operation by June 1. These additional fire stills were made necessary by reason of some of the old stills having been revamped and used in connection with the lube and wax plant which was placed in operation last January.

Catalog Features Wright Hoists

Wright hoists are featured in a catalog announced by the Wright Manufacturing Company, Lisbon, Ohio.

The catalog covers Wright high speed hoist parts, screw hoist parts, twin hook hoists, Army type trolley hoists, and trolleys and cranes.

Wright hoists are especially recommended for use about refineries.

Copies of the catalog will be sent upon application to the company.

Two More Compressors For West Texas Plant

Breckenridge, Tex.—Two compressor units are being added to the Wooten-Hughes Interests' natural gasoline manufacturing plant in the Frankel section of Stephens County to take care of new gas made available for the plant recently. The plant has been handling about 4,000,000 cubic feet of gas daily through three units, and the new equipment will make it possible to run slightly more than 7,000,000 cubic feet of gas daily. Headquarters are maintained at Ranger.

Clayton to Put in More Cross Units at Dallas

Dallas, Texas.—Two additional units of the Cross cracking process are being installed by the Clayton Oil and Refining Company at its refinery near Dallas, and it is planned to have both in operation by July 1. This plant was one of the first in Texas to install the Cross cracking process, and now has two units in use. The new installation will be of the late type, and will have a daily capacity of 1000 barrels each.

Heavy Duty Engine Booklet

Heavy stationary type oil engines manufactured by the McIntosh & Seymour Corporation, Auburn, New York, are described in detail in a bulletin recently issued by the company. These engines have gained widespread prominence among oil men where a heavy duty engine is demanded and some of the leading pumping stations in the country are equipped with McIntosh & Seymour products. Copies of the bulletin will be mailed to anyone interested.

Duquesne Burner Catalog

Duquesne combustion units, economical gas burners for all types of boilers, as described by the manufacturers, are shown in catalog No. 11, published by the Duquesne Burner Service Company, Pittsburgh, Pa.

The catalog tells how better combustion can be obtained by using Duquesne burners. Copies may be secured by writing the company.

COMPLETE LIST OF NATURAL GASOLINE PLANTS

KANSAS-OKLAHOMA-TEXAS-LOUISIANA-ARKANSAS-CALIFORNIA

The following list has just been finished and is by far the most complete list of its kind ever compiled. The capacities of the plants are given in gallons of gasoline with the exception of Texas where it is shown in million cubic feet of gas. Following is a key to abbreviations used: *Compression; †Absorption; ‡Compression and Absorption; §Booster Plant; ‖Absorption and Charcoal; ¶Million Cubic Feet of Gas.

KANSAS

Name, Address, Location, and R. R. Conn.	Type	Capacity
Parco Gasoline Co., Tulsa—		
Peru (AT&SF)	*	2,500
Sedan, (Mo.P.)	*	2,500
Empire Gasoline Co., Bartlesville—		
Ark. City, (AT&SF)	†	10,000
Caney, (AT&SF)	†	10,000
Cambridge, (AT&SF)	*	.....
Leon, (Frisco)	†	2,000
Madison, (AT&SF)	†	9,000
Madison, (AT&SF)	†	2,000
Sallyards, (Mo.P.)	†	3,900
Eureka Gasoline Co., Neodesha—		
Neodesha, (Mo.P.)	*	2,000
Lewis Oil Company, Tulsa—		
Gordon, (AT&SF)	†	5,000
Owen Gasoline Co., Caney—		
Caney, (AT&SF)	†	2,000
Pep Gasoline Co., Kansas City—		
Sedan, (Mo.P.)	*	1,000
Roth Gasoline Co., Independence—		
Elgin, (AT&SF)	*	2,000
Sproul Gasoline Co., Sedan—		
Peru, (AT&SF)	*	1,000
Tidal Refining Co., Tulsa—		
Douglass, (AT&SF)	†	10,000
Tower Gasoline Co., Okla. City—		
Caney, (AT&SF)	†	3,000
Swanson, Kelly & Noble Co., Tulsa—		
Elgin, (AT&SF)	†	500
Totals	†11-*7	68,400

OKLAHOMA

Name, Address, Location and R. R. Conn.	Type	Capacity
A. C. F. Gasoline Co., Tulsa—		
Oilton, (St. Fe)	*	1,000
Akin Gasoline Co., Tulsa—		
Bixby, (M.V.)	†	800
Dewey (2) (MK&T)	†	700
Amerada Pet. Corp., Tulsa—		
Brock, (St. Fe)	†	3,500
Tonkawa (St. Fe)	†	15,000
Amer. Gas & Car. Co., Indianapolis—		
Foyil, (Frisco)	*	1,200
Amity Gasoline Co., Bartlesville—		
Dewey, (MK&T)	*	2,000
Bristow, (Frisco)	*	1,500
Mounds, (Frisco)	*	500
McMann, (Frisco)	*	1,000
Watova, (2) (Mo.P.)	*	4,000
Anglo-Texas Oil Co., Tulsa—		
Stone Bulff, (M.V.)	*	400
Arrow Gasoline Co., Tulsa—		
Broken Arrow, (MK&T)	*	500
Arthur Oil Co., Tulsa—		
Sapulpa, (Frisco)	*	500
Atlantic Pet. Corp., Tulsa—		
Garber (Rk. Is.)	*	1,000
Leonard (M.V.)	*	1,200
Okmulgee, (Frisco)	*	1,500
Aztec Oil Co., Tulsa—		
Tiger, (.....)	*	1,000
B. & M. Gasoline Co., Tulsa—		
Bartlesville, (St. Fe)	*	1,000
Schulter, (Frisco)	*	2,000
Bankers Gasoline Co., Boynton—		
Boynton, (Frisco)	*	500
Bankers Oil Co., Boynton—		
Morris (Frisco)	*	500
Barbara Oil Co., Okmulgee—		
Okmulgee, (Frisco)	*	600
Barco Gaso. Co., (C. & S.) (Formerly Hamon Estate), Tulsa—		
Wirt, (ONM&P)	*	3,000
Barnsdall Corp., Tulsa—		
Avant, (M.V.)	†	1,500
Barnsdall, (M.V.)	†	2,500
Dewey, (MK&T)	*	400
Osage, (MK&T)	†	1,000
Turley, (M.V.)	†	1,000
Boynton Gaso. Co., Boynton—		
Chase, (Frisco)	*	2,500
Bradstreet & Co., Mukogee—		
Mukogee, (M.V.)	*	500
Cane Creek Pet. Co., Sapulpa—		
Boynton, (Frisco)	*	500
Carter Oil Co., Tulsa—		
Boynton, (Frisco)	*	800
Burbank, (St. Fe)	†	15,000
Oilton (2), (St. Fe)	*	2,400
Wann, (MK&T)	*	500
Wilson, (ONM&P)	*	8,500
Chase Gasoline Co., Sistersville—		
Muskogee (2), (MV-Frisco)	*	3,000
Glenpool, (4), (MV-Frisco)	‡	24,000
Chestnut & Smith Corp., Tulsa—		
Morris, (2), (Frisco)	*	4,500
Glenpool, (Frisco)	*	9,000
Muskogee, (MV)	*	2,500
Bristow, (Frisco)	‡	5,000
Drumright, (St. Fe)	*	10,000
Oilton, (St. Fe)	*	2,500
Chieftain Gaso. Co., Tulsa—		
Oilton, (St. Fe)	*	2,000
H. E. Clark, Philadelphia—		
Okmulgee, (Frisco)	*	500
Cloco Gasoline Co., Tulsa—		
Shamrock, (St. Fe)	*	2,000
Continental Gaso. Co., K. C. Mo.—		
Jenks, (MV)	†	3,000
Comar Gasoline Co., St. Louis—		
Marland, (2), (Pipe Line)	†	25,000
Cosden Oil & Gas Co., Tulsa—		
Drumright, (St.Fe)	*	13,000
Garber, (Rk. Is.)	*	2,500
Morris, (Frisco)	†	25,000
Shamrock, (Frisco)	*	10,000
Stone Bluff, (MV)	*	3,500
Crosbie & Gillespie, Tulsa—		
Keifer, (Frisco)	*	8,000
Cushing Ref. & Gaso. Co., Cushing—		
Engalls, (.....)	*	5,000
Dean Oil Co., Tulsa—		
Bartlesville, (St. Fe)	*	600
Denver Prod. & Ref. Co., Okmulgee—		
Nuyaka, (Okla.SW)	†	1,500
De Soto Gaso. Co., Beaumont, Tex.—		
Muskogee, (Frisco)	*	500
Wann, (MK&T)	*	200
Dewey Portland Cemt. Co., Dewey—		
Dewey, (MK&T)	*	2,000
Diamond Ref. Co., L. C. Mo.—		
Delaware, (MoP)	*	7,000
Jenks, (MV)	*	1,500
Jennings, (MK&T)	‡	3,000
Nowata, (MoP)	*	3,000
Ochelata, (St.Fe)	†	1,500
Dickenson, W. O., Tulsa—		
Bixby, (Pipe Line)	†	500
Dixie Oil Co., Tulsa—		
Wewoka, (Frisco-RI)	†	4,500
Eagle Gasoline Co., Tulsa—		
Glenpool, (Frisco)	*	4,000
Eagle Pitcher L & Z Co., Joplin—		
Henryetta, (Frisco)	†	5,000
Empire Gasoline Co., Bartlesville—		
Covington, (Frisco)	*	2,000
Okemah, (FS&W)	†	6,500
Tallant, (MV)	†	10,000
Enfisco Oil Corp., Tulsa—		
Glenpool, (2), (Frisco)	*	3,000
Flesher Pet. Co., Tulsa—		
Sperry, (MV)	†	500
Foster & Norwood, Bartlesville—		
Barnsdall, (MV-MK&T)	†	2,500
Foster & Davis, Bartlesville—		
Osage, (MV)	†	500
Four Gasoline Co., Tulsa—		
Bixby, (MV)	*	1,000
Franchot & Co., Tulsa—		
Keifer, (Frisco)	*	800
Gates Oil Co., Ardmore—		
Healdton, (St. Fe)	*	2,000
Gilliland Oil Co., Tulsa—		
Barnsdall, (MV)	*	600
Drumright, (St. Fe)	*	700
Oilton, (St. Fe)	*	600
Shamrock, (2) (Frisco)	*	4,600
Shamrock, (Frisco)	†	500
Gates Oil Co., Ardmore—		
Healdton, (ONM&P)	*	500
Glenn Gas Co., Tulsa—		
Glenpool, (Frisco)	*	2,000
Graham O. & G. Co., (Prairie), Tulsa—		
Pershing, (MK&T)	*	3,000
Grimes Gaso. Co., Tulsa—		
Haskell, (MV)	†	500
Gypsy Oil Co., Tulsa—		
Burbank, (2), (St. Fe-MV)	†	25,000
Cleveland (2), (MK&T)	*	8,000
Drumright, (St. Fe)	*	11,500
Jenks, (MV)	*	2,500
Keifer, (Frisco)	*	30,000
Shamrock, (Frisco)	*	9,000
Tonkawa, (St. Fe)	†	15,000
Hale & Cassidy, Cushing—		
Cushing, (St. Fe)	†	2,000
Harlis Oil & Gas Co., Tulsa—		
Avant, (MV)	*	1,100
Hastings Gaso. Co., Sapulpa—		
Sapulpa (2), (Frisco)	†	1,500
Hayner Pet. Co., Tulsa—		
Terlton, (MK&T)	*	500
Henderson Co., New York City—		
Nowata, (MoP-St. Fe)	*	16,000
Hesco Gaso. Co., Tulsa—		
Drumright, (St.Fe-Frisco)	*	1,200
Highway Oil & Ref. Co., Tulsa—		
Broken Arrow, (MK&T)	*	1,000
Jenks, (MV)	*	1,000
Leonard, (MV)	*	2,500
Okmulgee (3), (Frisco-KO&G)	*	3,000
Price, (Frisco)	*	750
Sapulpa, (Frisco)	*	1,500
Hoffenbecker Co., Tulsa—		
Cushing, (AT&SF)	*	1,000
Hope Gasoline Co., Tulsa—		
Tulsa, (Frisco-MV)	*	650
Hurley Gaso. Co., Tulsa—		
Beggs, (Frisco)	*	6,000
Ideal Gaso. Co., (SD), Tulsa—		
Terlton, (MK&T)	†	2,000
Indian Gasoline Co., Tulsa—		
Nuyaka, (Frisco)	*	6,000
Osage, (MK&T)	†	1,200
Invader O. & R. Co., Mukogee—		
Stone Bluff, (MV)	*	1,000
Johnson Gaso. Co., Red Fork—		
Red Fork, (Frisco)	*	350
Junior Ref. Co., Okmulgee—		
Okmulgee, (Frisco)	†	1,500
Kingwood Oil Co., Okmulgee—		
Okmulgee, (OklaN)	†	2,500
Lane Gasoline Co., Nowata—		
Nowata, (MoP)	*	300
Liberty Gaso. Co., Tulsa—		
Terlton, (MK&T)	*	2,000
Lily Gaso. Co., Sapulpa—		
Sapulpa, (Frisco)	*	600
Skiatook, (MV)	*	400
Liquified Pet. Co., Tulsa—		
Beggs, (Frisco)	†	3,000
Livingston Oil Corp., Tulsa—		
Bixby, (MV)	†	500
Bristow, (Frisco)	†	5,000
Magnolia Pet. Co., Dallas—		
Bartlett, (KO&G)	*	500
Cushing, (St.Fe)	*	2,250
Deware, (MK&T)	*	400
Duncan, (Rk.Is.)	†	2,500
Healdton (5), (ONM&P)	*	6,000
Quay (2), (MK&T-St.Fe)	*	6,500
Oilton (3), (St.Fe)	‡	7,300
Shamrock (5), (Frisco-St.Fe)	‡	20,000
Yale, (MK&T-St. Fe)	*	6,000
Marland Refg. Co., Ponca City—		
Ponca City, (St.Fe)	*	3,250
Ponca City, (St.Fe)	†	2,500
Ponca City, (St.Fe)	§	1,100
Mervine, (St.Fe)	*	6,000

Name, Address, Location and R. R. Conn.	Type	Capacity
Mason, D. B., Tulsa—		
Osage, (MK&T)	*	1,500
Bartlesville, (St.Fe)	†	1,500
McCaskey & Wentz, Ponca City—		
Peckham, (....)	*	4,000
Tonkawa, (AT&SF)	†	7,500
Meridian Pet. Co., (Receiver), Tulsa—		
Sapulpa, (Frisco)	*	750
Merrick Gaso. Co., Ardmore—		
Wirt, (ONM&P)	*	500
McMan Oil Co., Tulsa—		
Tonkawa, (St.Fe)	†	12,000
Mid-Co Gaso. Co., (Rec.), Tulsa—		
Billings, (CRI&P)	*	4,000
Dewey, (MK&T)	*	3,000
Drumright, (St.Fe)	*	1,000
Inola, (MP)	*	500
Oilton, (St.Fe)	*	5,000
Wann, (MK&T)	*	500
Mid-Continent Oil Dev. Co., Okmulgee—		
Okmulgee (Frisco)	*	1,500
Model Gasoline Co., Tulsa—		
Covington, (St.Fe)	*	3,000
Mohawk Refg. Co., Sand Springs—		
Sand Springs, (MK&T)	*	150
Monarch Gaso. Co., Tulsa—		
Glen Pool, (MV)	*	1,400
Motor Gaso. Co., Muskogee—		
Muskogee, (MV)	*	1,000
National O. & D. Co., Okla. City—		
Bartlesville, (St.Fe)	*	2,000
National Products Co., Tulsa—		
Cleveland, (MK&T)	†	2,600
Mounds, (Frisco)	†	600
Oilton, (St.Fe)	†	2,000
Slick, (Ok-So)	†	2,500
Terlton, (MK&T)	†	3,000
Nixon Oil Company, Tulsa—		
Owasso, (St.Fe)	†	500
Noble O. & G. Co., Tulsa—		
Quay, (MK&T)	†	3,500
Northland Gaso. Co., Tulsa—		
Sapulpa, (Frisco)	*	1,000
Nowata Oil & Ref. Co., Tulsa—		
Lenepah, (MoP)	*	900
Oil States Gaso. Co., Tulsa—		
Beggs, (2), (Frisco)	*	4,000
Jenks, (MV)	*	2,000
Okla. Gaso. Plants, Okla. City—		
Drumright, (St.Fe)	*	2,500
Oilton, (St Fe)	*	1,500
Okla. Gaso. & Oil Co., Tulsa—		
Mounds, (Frisco)	†	2,500
Sapulpa, (Frisco)	*	300
Stone Bluff, (MV)	†	3,000
Wynona, (MK&T)	†	3,000
Okla. Natural Gas Co., Tulsa—		
Kellyville, (Frisco)	†	3,000
Morrison, (Frisco)	†	1,000
Shamrock (Frisco)	†	500
Stroud, (Frisco)	†	1,000
Okla. Prod. & Ref. Corp., Tulsa—		
Mounds, (Frisco)	*	500
Okmulgee, (Frisco)	*	2,500
Orfic Gasoline Co., Tulsa—		
Cleveland, (MK&T)	*	2,500
Jennings, (MK&T)	†	2,500
Overland Gasoline Co., Tulsa—		
Sapulpa, (Frisco)	*	400
Owen Gaso. Co., Caney, Kan.—		
Boynton, (Frisco)	*	500
Paraffine Oil Co., Beaumont, Tex.—		
Barnsdall, (MV)	†	2,000
Peppers Gasoline Co., Enid—		
Osage, (MK&T)	*	800
Billings, (CRI&P)	*	1,200
Covington, (St.Fe)	*	3,000
Phillips Pet. Co., Bartlesville—		
Tonkawa, (St.Fe)	†	15,000
Bartlesville, (St.Fe)	*	1,000
Shidler (2), (Pipe Line)	†	45,000
DeNoya, (Pipe Line)	†	30,000
Bryant, (2) (Frisco)	†	14,500
Phillips, Waite, Co., Tulsa—		
Pershing, (MK&T)	†	15,000
Nuyaka, (St.Fe)	†	6 000
Beggs, (Frisco)	*	3,000
Polar P. & R. Co., Tulsa—		
Beggs, (Frisco)	*	1,500
Pine, W. B., Okmulgee—		
Haskell, (MV)	*	500
Powers & Quinlan, Tulsa—		
Laden, (....)	*	2,500
Preston, (Frisco)	*	2,500
Pulaski Oil Co., Tulsa—		
Depew, (Frisco)	†	3,500
Red Fork, (Frisco)	*	500
Drumright, (St.Fe)	*	9,000
Pure Oil Co., Columbus, O.—		
Haskell, (MV)	*	1,000
Healdton, (ONM&P)	*	5,000
Oilton, (St.Fe)	*	8,000
Rainbow Gaso. Co., Tulsa—		
Depew, (Frisco)	‡	3,500
Reco Gasoline Co., Okmulgee..		
Okmulgee, (Frisco)	*	1,500
Richmond Gasoline Co., Tulsa..		
Bowden, (Frisco)	*	350
Robinson & Ice, Tulsa—		
Leonard, (MV)	*	600
Rowland Gas Co. (Shaffer Tulsa—		
Chastain, (2) (....)	*	1,100
Wheeler, (....)	*	2,200
Oilton, (St.Fe)	*	1,000
Romarti Gasoline Co., St. Louis—		
DeNoya, (....)	‡	7,500
Roxana Pet. Corp., St. Louis—		
Drumwright, (St.Fe)	*	7,000
Covington, (St.Fe)	*	3,200
Yale, (St.Fe)	†	1,500
Rotary Gasoline Co., Tulsa—		
Sperry, (MV)	†	1,000
Sapulpa Refg. Co. (Rec.), Tulsa—		
Shamrock, (Frisco)	†	2,000
Savoy Oil Co., Tulsa—		
Porter, (MK&T)	†	500
Seaboard Oil & Gas Co., Mukogee—		
Eram, (Frisco)	*	1,000
Shaffer Oil & Refg. Co., Chicago—		
Beggs, (Frisco)	*	2,000
Cushing, (St.Fe)	†	1,000
Drumright, (St.Fe)	*	4,500
Shamrock, (Frisco)	*	2,500
Sinclair Oil & Gas Co., Tulsa—		
Bald Hill, (....)	*	2,200
Burbank, (St.Fe)	†	13,500
Covington, (St.Fe)	*	20,000
Drumright, (St.Fe)	*	8,000
Shamrock, (Frisco)	*	10,500
Stone Bluff, (MV)	*	800
Skelly Oil Co., Tulsa—		
Bristow, (Frisco)	†	12,000
Kaw City, (St.Fe)	†	13,500
Lyman, (MV)	†	10,000
Slick, (Frisco)	†	3,000
Wynona, (MK&T)	†	11,000
Thomas B. Slick, Tulsa—		
Shamrock, (Frisco)	*	500
Smith & Cleage, Tulsa—		
Stone Bluff, (MV)	*	1,250
Solar Products Co., Tulsa—		
Coweta, (MK&T)	†	2,500
Southland Gasoline Co., Tulsa—		
Sapulpa, (Frisco)	*	1,500
Boynton, (Frisco)	†	500
Oilton, (St.Fe)	*	1,800
Star Gasoline Co., Sapulpa—		
Eram, (Frisco)	†	1,500
Standard Oil Co. (Ind.), Chicago—		
Drumright, (2) (St.Fe)	*	35,000
Oilton, (St.Fe)	*	15,000
Shamrock, (2) (Frisco)	*	22,500
Stebbins Oil & Gaso. Co., Tulsa—		
Inola, (MoP)	*	1,500
Boynton, (Frisco)	*	500
Stoutz Bros. & Ennis, Mukogee—		
Muskogee, (MV)	*	700
Summers Gasoline Co., Henryetta—		
Henryetta, (MK&T)	*	1,000
The Texas Company, Houston—		
Bald Hill, (....)	*	6,500
Barnsdall, (MV)	*	2,000
Cleveland, (MK&T)	*	1,200
Drumright, (St.Fe)	*	20,000
Keifer, (Frisco)	*	18,000
Oilton, (St.Fe)	*	4,000
Preston, (Frisco)	*	1,800
Tidal Ref. Co., Tulsa—		
Delaware (2), (MoP)	*	2,000
Drumwright. (St.Fe)	†	13,500
Garber, (CRI&P)	*	1,200
Glenpool (2), (MV-Frisco)	‡	11,500
Keystone, (Frisco)	†	1,500
Ochelata, (St.Fe)	*	2,000
Tower Gasoline Co., Okla. City—		
Blackwell (2), (Frisco)	†	12,500
Cushing, (St.Fe)	†	7,500
Okmulgee, (Frisco)	†	3,500
Peckham, (....)	†	3,000
Yale, (St.Fe)	†	4,000
Transcontinental O. Co., Pittsburgh—		
Alluwe, (....)	*	2,500
Bald Hill, (....)	*	2,500
Bristow, (Frisco)	*	10,000
Delaware (3), (M.P)	*	4,000
Haskell, (MV)	*	1,000
Morris (3), (Frisco)	*	7.500
Nowata (2), (MoP)	*	4,000
Tribes Gasoline Co., Tulsa—		
Henryetta, (MK&T)	†	2,500
Jenks, (MV)	*	1,800
Mehan, (....)	†	2,200
Tulsa Gaso. Mfg. Co., Tulsa—		
Glenpool, (MV-Frisco)	*	400
Twin States Oil Co., Tulsa—		
Quay. (MK&T)	*	4,500
Twitchell & Myers. Okmulgee—		
Schulter, (Frisco)	*	400
Virginia-California Gaso. Co., Muskogee—		
Eram, (Frisco)	*	1,000
Water White Gaso. Co., Tulsa—		
Collinsville, (St.Fe)	*	1,000
White Oak Gas Co. (Waite Phillips) Tulsa—		
Beggs. (Frisco)	*	5,000
White Oil Corp., Houston—		
Drumright, (St.Fe)	*	2,000
Oneta. (Frisco)	*	1,000
Wilcox O. & G. Co., Tulsa—		
Beggs (2), (Frisco)	*	5,000
Slick, (Frisco)	†	3,500
Wolverine Oil Co. (Roxana), Tulsa—		
Avant (?), (MV)	*	6,000
Bartlesville (2), (St.Fe)	*	5,500
Copan, (St.Fe)	*	3,000
Wayside, (St.Fe)	*	600
Dillard, (....)	*	12,000
Wilson. H. C., Tulsa—		
Depew, (Frisco)	†	3,000
Woodward, Geo. et al, Nowata—		
Nowata, (MoP)	*	500
Wroster Oil Company, Tulsa—		
Nuyaka, (Okla-So)	*	4,000
Engalls, (....)	*	2,500
Totals .....*89; †201; ‡8;		1,325,700 Gals.

Total Recapitulation

	Abs.	Comp.	Both	Total	Total Capacity
Totals	129	219	9	357	1,560,800

ARKANSAS

Name, Address, Location and R. R. Conn.	Type	Capacity
Arkansas Natl. Gas Co., Shreveport—		
Eldorado, (E&W-RI)	†	3,500
Constantin Oil Corp, (Rec.), Tulsa—		
Eldorado, (RI-MoP)	†	2,000
Eldorado Natl. Gas Co., Eldorado—		
Eldorado, (RI-MoP)	‡	1,500
Henderson, F. C. Co., New York—		
Elodrado, (RI-MoP)	†	18,000
Koppers Company, Pittsburgh—		
Eldorado, (RI-MoP)	†	7,500
Marr Oil Corp., Eldorado—		
Eldorado, (E&W-RI)	†	6,500
McMillian, Fehlman & Oliver, Eldorado—		
Eldorado, (E&W-RI)	†	3,500
Natl. Gas & Pet. Corp., Eldorado—		
Eldorado (2), (E&W-MoP-RI) ..	†	17,500
Standard Oil Co. (La.), Shreveport—		
Eldorado, (RI-MoP)	†	9,500
Stebbins O. & G. Co., Tulsa—		
Eldorado, (RI-MoP)	*	2,500
Totals .....†8; *1; ‡1;,		72,000 Gals.

LOUISIANA

Name, Address, Location and R. R. Conn.	Type	Capacity
Atlas Oil Co., Monroe—		
Swartz, (MoP)	†	1,000
Caddo Central O. & R. Co., Shreveport—		
Cedar Gr., (KCS)	*	800
Clairborne Gas Co., Shreveport—		
Homer, (L&NW)	*	2,000
DeSoto Gas Co., Beaumont—		
Goss, (T&P)	†	1,000
Gill land Oil Co., Tulsa—		
Homer, (L&NW)	*	4,000

Name, Address, Location and R. R. Conn.	Type	Capacity
Gulf Refining Co., Shreveport—		
Morgansport, (KCS)	*	5,500
Naborton, (Lbr. Road)	†	1,000
Homer, (L&NW)	†	15,000
Higgings O. & F. Co., Houston—		
Caddo, (L&NW)	†	200
Humphreys Carbon Co., Tulsa—		
Swartz, (MoP)	†	3,000
Huber, J. M., & Co., Swartz—		
Swartz, (MoP)	†	1,000
Louisiana Gas Co., Shreveport—		
Cedar Gr., (KCS)	†	2,000
Louisiana O. & R. Co., Shreveport—		
Homer, (L&NW)	*	4,500
Mag. Pet. Co. (Fortuna), Dallas—		
Gahagan, (T&P)	*	500
Nelson, Oscar, Monroe—		
Lamkin, (MoP)	†	1,000
Reserve Nat. Gas Co., Shreveport—		
Cedar Grove, (KCS)	†	1,500
Southern Carbon Co., Monroe—		
Fairbanks, (A&LM)	†	3,000
Perryville, (A&LM)	†	1,000
Spyker, (A&LM)	†	1,000
Swartz, (MoP)	†	3,000
SW Gas & Elec. Co., Shreveport—		
Cedar Grove, (KCS)	†	2,200
Standard Carbon Co., Monroe—		
Swartz, (MoP)	†	3,000
Standard O. Co. (La.), Shreveport—		
Elm Grove, (LR&N)	†	1,000
Homer, (L&NW)	†	15,000
Oil City, (KCS)	*	1,000
Trees City, (KCS)	*	4,000
Texas Company, Houston—		
Goss, (T&P)	*	3,000
Oil City (2), (KCS)	*	5,500
Texas-La. Prod. Co. Monroe—		
Wham, (MoP)	†	1,500
United O. & N. G. Prod. Co., Monroe—		
Gorgas, (A&LM)	†	2,000
White Oil Corp., Houston—		
Homer, (L&NW)	†	4,500
Totals	†21;	*10; 94,700

TEXAS

Name, Address, and Location	Type	Capacity
Dixie Gasoline Company, P. O. Box No. 595, Cisco Texas—		
Brown County	†	¶5
Lone Star Gas Co., American Ex. Bank Bldg., Dallas, Texas—		
Clay County	†	¶50
Lone Star Gas Co., American Ex. Bank Bldg., Dallas, Texas—		
Clay County	*	¶½
Magnolia Petroleum Company, Magnolia Bldg., Dallas, Texas —		
Comanche County	*	¶1
Lone Star Gas Co., American Ex. Bank Bldg., Dallas, Texas—		
Cooke County	†	¶40
Arab Gasoline Corp., P. O. Box 997, Eastland, Texas—		
Eastland County	†	6
Arab Gasoline Corp., P. O. Box 997, Eastland, Texas—		
Eastland County	†	¶11
Arkansas Fuel Oil Co., Ardis Bldg., Shreveport, La.—		
Eastland County	†	¶5
Arkansas Fuel Oil Co., Ardis Bldg., Shreveport, La.—		
Eastland County	†	¶6
Chestnut & Smith Corp., Chestnut & Smith Bldg., Tulsa, Okla.—		
Eastland County	†	¶4
Chestnut & Smith Corp., Chestnut & Smith Bldg., Tulsa, Okla.—		
Eastland County	†	¶4
Chestnut & Smith Corp., Chestnut & Smith Bldg., Tulsa, Okla.—		
Eastland County	†	¶10
Chestnut & Smith Corp., Chestnut & Smith Bldg., Tulsa, Okla.—		
Eastland County	†	¶26
Chestnut & Smith Corp., Chestnut & Smith Bldg., Tulsa, Okla.—		
Eastland County	†	¶18
Consolidated Gasoline Co. (Hickok Prod. Co.) Eastland, Texas—		
Eastland County	†	¶6
Crosby & Sweet, Desdemona, Texas—		
Eastland County	†	¶¼
Desdemona Gasoline Co., 1209 F&M Bank Bldg., Fort Worth, Texas—		
Eastland County	†	¶2
Finco Gasoline Prod. Co., Kennedy Bldg., Tulsa, Okla.—		
Eastland County	†	¶2
Gulf Prod. Co., Gulf Bldg., Houston, Texas—		
Eastland County	†	¶1¼
Gulf Production Co., Gulf Bldg., Houston, Texas—		
Eastland County	†	¶6
Hall Gasoline Co., (was Revere Oil Co.), Desdemona, Texas—		
Eastland County	†	¶½
Hirt-MacDermott Gasoline Co., 1209 F&M Bank Bldg., Fort Worth—		
Eastland County	†	¶2
Humble Oil & Ref. Co., Humble Bldg., Houston, Texas—		
Eastland County	*	¶1½
Magnolia Petroleum Co., Magnolia Bldg., Dallas, Texas—		
Eastland County	*	¶2
Magnolia Petroleum Co., Magnolia Bldg., Dallas, Texas—		
Eastland County	*	¶1½
Magnolia Petroleum Co., Magnolia Bldg., Dallas, Texas—		
Eastland County	*	¶2
Magnolia Petroleum Co., Magnolia Bldg., Dallas, Texas—		
Eastland County	*	¶3½
Magnolia Petroleum Co., Magnolia Bldg., Dallas, Texas—		
Eastland County	*	¶4½
Magnolia Petroleum Co., Magnolia Bldg., Dallas, Texas—		
Eastland County	*	¶3½
Magnolia Petroleum Co., Magnolia Bldg., Dallas, Texas—		
Eastland County	*	¶3
Magnolia Petroleum Co., Magnolia Magnolia Bldg., Dallas, Texas—		
Eastland County	*	¶1½
Majestic Gasoline Co., 1209 F&M Bank Bldg., Fort Worth, Texas—		
Eastland County	†	¶2
McMan Oil & Gas Co., Drew Bldg., Tulsa, Okla.—		
Eastland County	‡	¶1½
Mid-Kansas Oil & Gas Co., 537 S. Main St., Findlay, Ohio—		
Eastland County	†	¶1
Orfir Gasoline Production Co., Tulsa, Okla.—		
Eastland County	*	¶1½
Phillips Petroleum Co., Phillips Bldg., Bartlesville, Okla.—		
Eastland County	†	¶10
Phillips Petroleum Co., Phillips Bldg., Bartlesville, Okla.—		
Eastland County	†	¶6
Phillips Petroleum Co., Phillips Bldg., Bartlesville, Okla.—		
Eastland County	†	¶15
Phillips Petroleum Co., Phillips Bldg., Bartlesville, Okla.—		
Eastland County	†	¶4
Straits Gasoline Co., P. O. Box 192, Ranger, Texas—		
Eastland County	†	¶1½
Texas Gasoline Co., 1209 F&M Bank Bldg., Fort Worth—		
Eastland County	†	¶1
Texas Pacific Coal & Oil Co., Thurbur, Texas—		
Eastland County	†	¶8
Universal Product Co., Eastland Texas—		
Eastland County	†	¶1
Western Gasoline Corp. (was Benwick), Dan Waggoner Bldg., Fort Worth,—		
Eastland County	†	¶8
World Gasoline Co., P. O. Box 946, Desdemona, Texas—		
Eastland County—	†	¶1½
Magnolia Petroleum Co., Magnolia Bldg., Dallas, Texas—		
Erath County	*	¶1½
Humble Oil & Ref. Co., Humble Bldg, Houston, Texas—		
Navarro County	†	¶9
John C. Burkett, Mineral Wells, Texas—		
Palo Pinto County	†	¶2½
Lone Star Gas Co., American Bank Bldg., Dallas, Texas—		
Palso Pinto County	†	¶15
Lone Star Gas Co., American Ex. Bank Bldg., Dallas, Texas—		
Palo Pinto County	‡	¶60
Cannon Gasoline Co., Amarillo, Texas—		
Potter County	†	¶30
Landreth Gasoline Co., First National Bank Bldg., Breckenridge, Texas—		
Shackelford County	‖	¶50
Absoline Gasoline Co. (was DeWitt Co.), Breckenridge, Texas—		
Stephens County	†	¶1
Baltic Gasoline Co., P. O. Box 938, Ranger, Texas —		
Stephens County	†	¶6
Bradley Co., Breckenridge, Texas (shutdown)—		
Stephens County	†	¶1
Breckenridge Gas Co. (Hickkok Production Co.), Breckenridge, Texas—		
Stephens County	†	¶3
Brooks & Hanlon, Inc., Chestnut & Smith Bldg., Tulsa, Okla.—		
Stephens County	‡	¶28
Gulf Production Co., Gulf Bldg., Houston, Texas—		
Stephens County	†	¶2
Stephens County	†	¶5
Stephens County	†	¶7
Stephens County	†	¶2
Hanlon Gasoline Co., Chestnut & Smith Bldg., Tulsa, Okla.—		
Stephens County	†	¶12
Stephens County	†	¶45
Hurley-Texas Gasoline Co., Kennedy Bldg., Tulsa, Okla.—		
Stephens County	†	¶9
J. T. Gasoline Co. (Hope Eng. & Supply Co.), Breckenridge, Texas—		
Stephens County	†	¶10
Magnolia Petroleum Co., Magnolia Bldg., Dallas, Texas—		
Stephens County	†	¶5
Stephens County	‡	¶4
Stephens County	†	¶6
Mid-Kansas Oil Co., 537 S. Main St., Findlay, Ohio—		
Stephens County	†	¶9
National Products Co., 1209 F&M Bank Bldg., Fort Worth—		
Stephens County	†	¶5
Stephens County	†	¶5
Stephens County	†	¶1½
Phillips Pet. Co., Phillips Bldg., Bartlesville, Okla.—		
Stephens County	†	¶12
Rochester Gasoline Co., Ivan, Texas—		
Stephens County	†	¶4½
Roeser & Pendleton Gasoline Co., P. O. Box 1618, Breckenridge, Texas—		
Stephens County	†	¶14
Stephens County	†	¶9
Shield Petroleum Corp. (Chestnut & Smith), Chetnut & Smith Bldg., Tulsa, Okla.—		
Stephens County	†	¶8
Snowden & McSweeney, Breckenridge, Texas	†	¶5
Southern Gasoline Co., Ranger, Texas—		
Stephens County	†	¶4
Texas Pacific Coal & Oil Co.,		

Name, Address, and Location	Type	Capacity
Thurber, Texas—		
Stephens County	†	¶14
The Texas Co., Texas Bldg., Houston, Texas—		
Stephens County	‡	¶10
Western Gasoline Prod. Co., Breckenridge, Texas—		
Stephens County	†	¶12
Westover Oil & Gas Co. (Hope E. & S. Co.), Breckenridge, Texas—		
Stephens County	†	¶20
Stephens County	†	¶15
Wooten-Hughes Corp., P. O. Box 1056, Ranger, Texas—		
Stephens County	†	¶3
Stephens County	†	¶5
American Gas Co. (was Invader), City National Bank Bldg., Wichita Falls, Texas—		
Wichita County	*	¶⅓
Bellby Natural Gasoline Co., 504 Cosden Bldg., Tulsa, Okla.—		
Wichita County	†	¶¼
Wichita County	‡	¶2
H. E. Boner Gas Co., 3rd floor City Nat'l Bank Bldg., Wichita Falls, Texas—		
Wichita County	†	¶2
Gulf Production Co., Gulf Bldg., Houston, Texas—		
Wichita County	*	¶½
Wichita County	*	¶¼
Wichita County	*	¶½
Wichita County	*	¶½
Wichita County	*	¶¼
Humble Oil & Ref. Co., Humble Bldg., Houston, Texas—		
Wichita County	*	¶1
Wichita County	*	¶½
Wichita County	*	¶½
Interstate Gasoline Co., Staley Bldg., Wichita Falls, Texas—		
Wichita County	*	¶⅓
Magnolia Petroleum Co., Magnolia Bldg., Dallas, Texas—		
Wichita County	*	¶½
Wichita County	*	¶⅓
Wichita County	*	¶3
Wichita County	*	¶½
McMan Oil & Gas Co., Drew Bldg., Tulsa, Okla.—		
Wichita County	*	¶1½
Noble Oil & Gas Co., Wright Bldg., Tulsa, Okla.—		
Wichita County	*	¶2
Wichita County	*	¶2
Oklahoma Petroleum & Gasoline Co., Petroleum Bldg., Tulsa, Okla.—		
Wichita County	*	¶⅔
Omar Gasoline Co., City National Bank Bldg., Wichita Falls, Texas—		
Wichita County	*	¶¾
Peer Oil Corp., Humble Bldg., Houston, Texas—		
Wichita County	*	¶½
Sinclair Oil & Gas Co., Sinclair Bldg., Tulsa, Okla.—		
Wichita County	*	¶2
W. G. Skelly Interests, Skelly Bldg., Tulsa, Okla.—		
Wichita County	*	¶⅓
Wichita County	*	¶⅔
Wichita County	*	¶1
Texhoma Oil & Ref. Co., City National Bank Bldg., Wichita Falls, Texas—		
Wichita County	*	¶⅔
Wichita County	*	¶½
The Texas Company, Texas Bldg., Houston, Texas—		
Wichita County	*	¶⅓
Wichita County	*	¶1½
Tidal Western Oil Corp., 504 Cosden Bldg., Tulsa, Okla.—		
Wichita County	*	¶1½
Wichita County	*	¶2½
Magnolia Petroleum Co., Magnolia Bldg., Dallas, Texas—		
Wilbarger County	*	¶1
Phillips Petroleum Co., Phillips Bldg., Bartlesville, Okla.—		
Young County	*	¶10
Young County	†	¶6
Young County	†	¶3
Young County	†	¶8
Young County	†	¶2
Whittier & Wootan Co., 1209 F&M Bldg., Fort Worth, Texas—		
Young County	†	¶2

CALIFORNIA

Name, Address, and Location	Type	Capacity
American Gasoline Co., 1065 Central Bldg., Los Angeles—		
Whittier	†	.....
Bank Lint Oil Co., Higgins Bldg., Los Angeles—		
Signal Hill	†	20,000
Brea Gasoline Co., Higgins Bldg., Los Angeles—		
Brea	*	2,000
California Gasoline Co., 433 A. G. Bartlett Bldg., Los Angeles—		
Signal Hill	†	6,500
California Pac. Oil Co., 303 W. Wilshire, Fullerton, Calif.—		
Santa Fe Springs	†	2,000
California Refineries. Now being built—		
Santa Fe Springs	†	60,000
Calhambra Refineries—		
Santa Fe Springs	†	3,000
Calumet Oil Company, 517 I. W. Hellman Bldg., Los Angeles—		
Venture-Newhall	*	450
Central Oil Co., H. W. Hillman Bldg., Los Angeles—		
Whittier-La Habra-Monebello	†	400
Dabney Oil Syndicate, A. G. Bartlett Bldg., Los Angeles—		
Signal Hill	†	2,500
Export Refining Company, (now being built)—		
Torrance	†	15,000
Fellows Gaso. Co., 27th and Santa Fe Sts., Los Angeles—		
Santa Fe Springs	†	24,000
Huntington Beach	*	5,000
O. C. Fields Gasoline Co., 343 Sansome St., San Francisco—		
Huntington Beach	†	20,000
Fullerton Oil Co., Merchants Nat. Bank Bldg., Los Angeles—		
Brea	†	1,400
Whittier-La-Habra-Montebello	*	2,000
General Petroleum Co., Higgins Bldg., Los Angeles—		
Brea	*	800
Santa Fe Springs	†	40,000
Gilmore Petroleum Co., Van Nuys Bldg., Los Angeles—		
Salt Lake	*	400
Signal Hill	‡	6,000
Globe Petroleum Co., Central Bldg., Los Angeles—		
Huntington Beach	*	2,000
Golden State Refineries, 917 Hibernian Bldg., Los Angeles— Proposed.		
Helcher & Thompson, Canton and California Sts., Long Beach—		
Signal Hill	†	1,000
High Power Company, Huntington Beach—		
Huntington Beach	†	3,000
Holly Oil Company, Huntington Beach—		
Huntington Beach	†	5,500
Huntington Gaso. Co., Long Beach, (now being built)—		
Huntington Beach	†	1,500
Hurley-Smith No. 3, Haas Building, Los Angeles—		
Brea	*	350
Hurley-Smith No. 4, Haas Building, Los Angeles—		
Salt Lake	*	900
Hydro-Carbon Products Co., Kinhoff Bldg., Los Angeles, (now being built)—		
Santa Fe Springs	†	.....
Industrial Fuel Supply Co., Los Nietos—		
Santa Fe Springs	§	10,000
John F. Knudson Co., Huntington Beach—		
Huntington Beach	†	5,000
La Habra Gaso. Co., No. 5, Haas Bldg., Los Angeles—		
Brea	*	900
Leonard Company, Sespe, Calif.—		
Venture-Newhall	*	.....
Lomita Gaso. Co., (Southern Counties Gaso. Co.),—		
Signal Hill	†	8,000
Los Gasoline Co., Van Nuys Bldg., Los Angeles—		
Torrance	†	5,000
Montebello Oil Co., 485 S. Spring St., Los Angeles—		
Venture-Newhall	†	2,500
M. H. Mosier Special, Selby Root, Huntington Beach—		
Huntington Beach	*	2,000

PRATT & CADY VALVES

Pratt & Cady 300 pound test gate valves are in stock in stationary or rising spindle types and screwed end or flanged end.

Years of satisfactory service, which result from the quality of metals and closely gauged machining, may be added to by taking advantage of the reversible disc feature.

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GRINNELL CO., OF THE PACIFIC, Los Angeles, California

Name, Address, and Location	Type	Capacity
National Products Co., 212 N. Spring St., Los Angeles—		
Venture-Newhall	*	1,000
Brea	*	1,000
New Penn. Petroleum Co., Santa Maria, Calif.—		
Venture-Newhall	†	.....
Norwalk Company, Higgins Bldg., Los Angeles—		
Santa Fe Springs	†	30,000
Oil Rectifying & Marketing Co., (now being built)—		
Huntington Beach	†	5,000
Olinda Gaso. Company, No. 1, Van Nuys Bldg., Los Angeles—		
Olinda Refrigertor		1,500
Olinda (No. 2	*	5,000
Pacific Gaso. Corp., 931 Consolidated Realty Bldg., Los Angeles, (now being built)		
Signal Hill	†	.....
Huntington Beach	†	7,000
Pacific Gasoline Company, 629 S. Spring St., Los Angeles—		
Santa Fe Springs	†	20.000
Santa Fe Springs	†	10,000
Huntington Beach	†	35,000
Venture-Newhall	†	1,500
Torrance (now being built)	†	.....
Brea	†	1,000
Pacific Natural Gas Co., 808 City Nat. Bank Bldg., Los Angeles—		
Santa Fe Springs	†	2,500
Pacific Petroleum Corporation—		
Signal Hill	†	20,000
Pan American Company—		
Torrance	†	.....
Petroleum Corporation, Pacific Finace Bldg., Los Angeles—		
Santa Fe Springs	†	.....
Petroleum Mid-Way, Security Bldg., Los Angeles—		
Huntington Beach	†	6,000
Signal Hill	†	20,000
Petroleum Securities Company, Van Nuys Bldg., Los Angeles—		
Torrance	†	.....
Rancho La Brea Oil Co., 908 Merchants Nat. Bank Bldg., Los Angeles—		
Salt Lake	*	1,600
Red Star Petroleum Co., Security Bldg., Los Angeles—		
Whittier-La Habra-Montebello	†	1,000
Rex Gasoline Co., 1025 A. G. Bartlett Bldg., Los Angeles—		
Santa Fe Springs	†	10,000
Rio Grande Oil Co., 7th and Hill Bldg., Los Angeles—		
Santa Fe Springs	†	8,000
Sandoma Gasoline Co., A. G. Bartlett Bldg., Los Angeles—		
Santa Fe Springs	†	6,000
Santa Fe Carbon Company, 877 Black Bldg., Los Angeles—		
Signal Hill	†	.....
F. M. Selby Company, Fullerton, California—		
Richfield	†	100
Selby-Root Gasoline Co., Huntington Beach—		
Huntington Beach	†	1,000
Sentinel Oil Company, (Now being built)—		
Torrance	†	5,000
Shell Company of Calif., Higgins Bldg., Los Angeles—		
Signal Hill	†	20,000
Santa Fe Springs (now being built)	†	.....
Huntington Beach	†	7,000
Venture-Newhall	†	2,000
Whittier-La-Habra-Montebello	†	2,000
Olinda	†	1,000
Olinda	†	400
Brea	†	6,000
Brea (now being built)	†	.....
Signal Hill Gaso. Company, H. W. Hellman Bldg., Los Angeles—		
Signal Hill	†	10,000
Signal Gasoline Co., Long Beach—		
Signal Hill	†	4,500
Sonada Gasoline Co., 903 Wright-Callender Bldg., Los Angeles—		
Santa Fe Springs	*	5,000
Southern California Edison Co., Edison Bldg., Los Angeles—		
Salt Lake	*	400
Southwest Gasoline Co., 433 A. G. Bartlett Bldg., Los Angeles—		
Signal Hill	†	10,000
Standard Oil Co., of California, Higgins Bldg., Los Angeles—		
Santa Fe Springs	†	20,000
Santa Fe Springs	†	20,000
Huntington Beach	*	10,000
Venture-Newhall	†	1,000
Whittier-La Habra-Montebello	*	2,000
Whittier-La-Habra-Montebello	†	
Richfield	†	6,000
Sterling Gasoline Co., Security Bldg., Los Angeles—		
Huntington Beach	*	5,000
Sterling Gasoline Co., Walnut and Hill Sts., Long Beach—		
Signal Hill	†	4,000
St. Helens Petroleum Co., C. C. Chapman Bldg., Los Angeles—		
Whittier-La-Habra-Montebello	†	1,000
Brea	*	200
The Petroleum Company, 407 Consolidated Realty Building, Los Angeles—		
Signal Hill	†	.....
Brea	†	100
Titan Gasoline Co., Long Beach—		
Signal Hill	†	3,000
Torrance Gasoline Co., Van Nuys Bldg., Los Angeles—		
Torrance	†	5,000
Transport Oil Co., Long Beach, (now being built)—		
Signal Hill	†	.....

(Continued on Page 40)

SPEAKING OF REPUTATIONS

A high reputation is never the result of chance. Underneath it you will find the rock hewn foundation of real worth.

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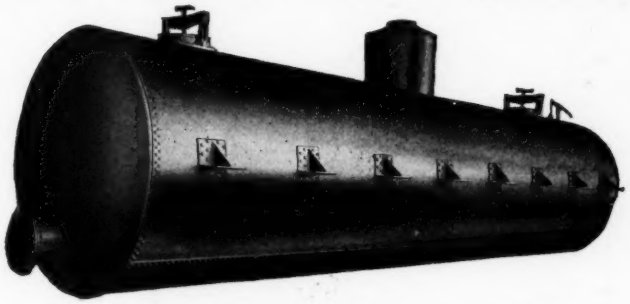

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Double riveted throughout. One piece head flanged and dished. Fire course is one sheet of still bottom steel. Shell built with four seams horizontally—NO ROUNDABOUT SEAMS—offering less possibility of leaks. Lugs are our design of built up steel plate.

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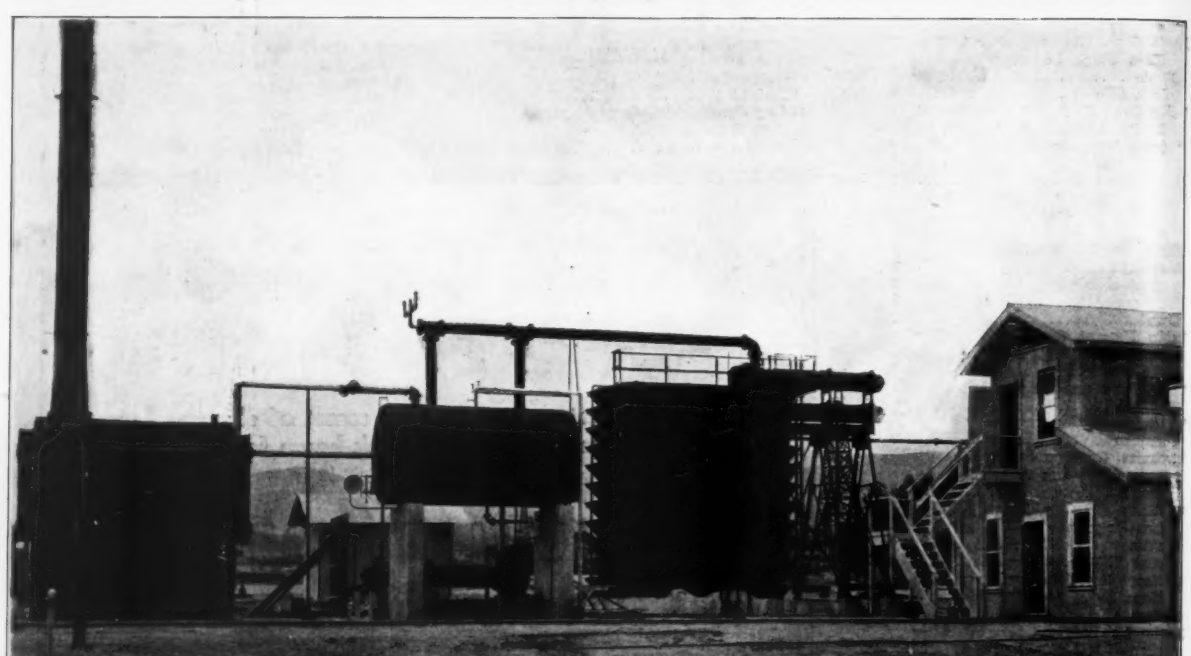

A Thousand Barrel Topping Plant Equipped With BRAUN Distillate Condensers, Heat Exchangers, and Cooling Tower

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Casing Head Gasoline Recovery Plants,
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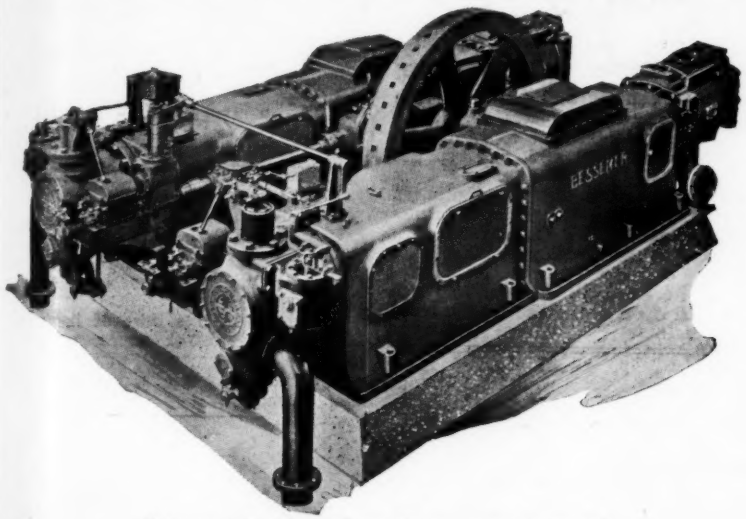
NEW EQUIPMENT, CATALOGS, BULLETINS, BOOKS



Bessemer twin cylinder, four-cycle, compressor power unit

Bessemer Announces New Four-Cycle Compressor

Simplicity and sturdiness are combined into the outstanding feature of the Bessemer Gas Engine Company's type FC-1, four-cycle compressor, according to the manufacturers. The assembled unit is rigid, and compact with no moving parts on the outside of the engine, eliminating possibility of accidents to operators or passersby.

A crank case and crosshead guide comprise the main frame, with the crank case member carrying the main bearing. The left hand crank case also carries the gear box from which the layshaft is operated. Each crank case is fitted at the top with a removable ventilated hood.

Quarter box type bearings are used. They are easily inspected by means of an opening, and permit wear to be taken up by means of a wedge adjustable from the top of the cap by means of screws.

Unusual strength characterizes the connecting rods. The crank pin end is of the marine type with a babbitt lined bronze shell. The cap is held to the head of the rod by four large bolts. The crosshead pin box consists of a bronze shell pressed into the road head. Both bearings are of liberal size, insuring low unit bearing pressure.

Uniform cylinder wear is insured by the crosshead construction, standard in all Bessemer equipment. The main crosshead is a steel casting with babbitt faced shoes, adjustable to take up wear by means of shims. There are two shoes to each crosshead, each shoe being securely fastened to the crosshead by four large cap bolts.

As in the power cylinder, the compressor cylinder also employs the crosshead principle. A cast steel yoke is placed back of each main crosshead. This yoke has two arms which support the outer ends of the side rods, the inner ends being supported by two similar arms which are cast integral with the compressor crosshead. Adjustable shoes are also fitted to this crosshead while both main and compressor crossheads run in bored guides.

Pistons are of the open trunk type, each being fitted with four rings. Construction permits free circulation of air inside the piston and enables the pistons to be easily removed from the cylinders.

Inlet and exhaust valves are placed vertically and mounted in cages which may be removed from the cylinder head without disturbing any pipe connections.

The layshaft drive consists of a spiral cut spur gear on the crankshaft, which drives a similar gear on an intermediate shaft back of and parallel to the crankshaft.

Governing is effected by means of throttling mixing valves which are conrolled by a governor of the Jahns type.

Two oscillating high tension magnetos are used, each being operated from the end of the layshaft, so that the spark may be set to occur at the most advantageous place for either starting or running. Each magneto may be advanced or retarded.

Oil is supplied from a force feed pump which may be timed to deliver oil at the proper point in the piston stroke, at three places.

Further information may be secured by writing the Bessemer Gas Engine Company, Grove City, Pa.

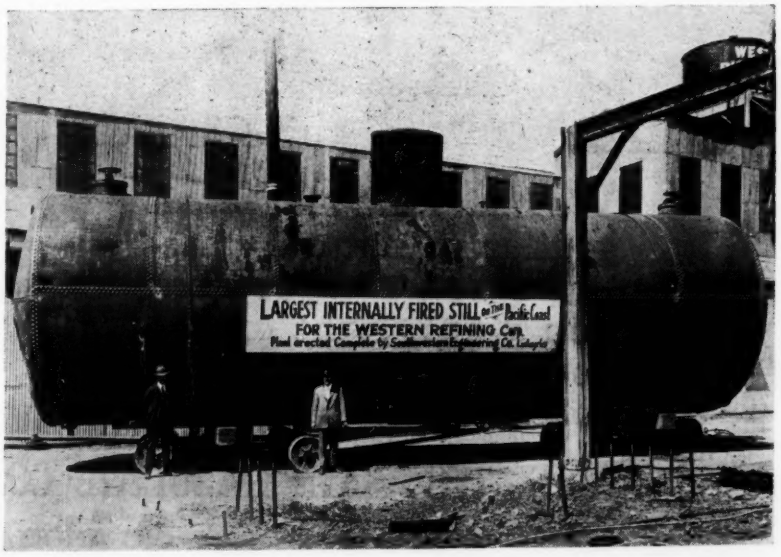
New California Refinery To Use Extra Large Stills

Los Angeles, Calif.—The first 5000-barrel refining unit of the 15,000-barrel refinery being built at the Los Angeles harbor for the Western Refining Company by the Southwestern Engineering Corporation of Los Angeles is rapidly nearing completion.

The still units in this plant are of unusual interest in that they are the largest of their kind ever erected on the Pacific coast. The first still battery will consist of four internally fired stills.

The ground work consisting of roads and dykes has been completed. The first thirteen run-down tanks are complete and are ready for their refined products. Two 55,000-barrel storage tanks have been erected and tested and are now ready to receive crude oil. Four additional 55,000-barrel tanks are in course of delivery and erection at the refinery. The large storage tanks will consist of one water seal tank, and five cone top gas-tight tanks.

The electric lighting and power lines have been run throughout the hundred



acre tract. The water mains have been installed. Foundations for all building and laboratories have been completed and fully equipped. The experimental and pilot refining unit has been completed and in operation over the last month. All steel buildings are at this time practically complete. The miscellaneous refinery apparatus, inclusive of piping and fittings has been assembled and is ready to move to the refinery as soon as the final stills have been set in place.

Two stills have already been delivered to the refinery and are in their cradles. The additional two stills to complete the first unit will be delivered by or before the first of June. As soon as the final stills have been delivered the miscellaneous equipment will be immediately set in place.

Quigley Furnace Company Announces New Products

Quigley Furnace Specialties Company, 26 Cortlandt Street, New York City, has recently issued literature on Quigley acid-proof cement, and Ganisand, two new products being manufactured by that company. Quigley acid-proof cement is a ready to use cement for bonding and surfacing acid-resisting masonry, and Ganisand is a highly refractory Ganister for lining and repairing industrial furnaces and making refractory tile and special shapes.

The company is also distributing a bulletin containing an article on refractory linings by W. H. Gaylord, Jr., president of the Quigley Furnace Specialties Company.

This literature will be sent to those interested upon application to the company.

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for

COMPRESSION and Absorption Gasoline

Swift Shipments from

OKLAHOMA

TEXAS LOUISIANA

We make and market all grades of natural gasoline. You can get what you want, right on the dot, when you entrust your order to Akin.

THE AKIN GASOLINE CO.

Exchange National Bank Building

TULSA :—: :—: OKLAHOMA

Booklet on Superheated Steam

"Origin, Development, Results o. Elesco," is the subject of a booklet which has been published by the Superheater Company, 17 East Forty-Second Street, New York City. The booklet gives the development of the use of high degree superheated steam and discusses the products of the company, and their application to all industrial needs. Copies of the booklet may be secured by writing the company.

Booklet on Gathering Systems

A booklet discussing vacuum vapor gathering systems has recently been issued by the Vacuum Control Company, Topeka, Kansas, and is ready for free distribution to those interested in this subject.

The booklet is a sort of handbook of vacuum control vapor gathering systems for lease tanks, pipe line gathering and relay tanks, refineries and tank farms.

Bulletin on Drop Forged Fittings

H-P-M drop forged fittings for super-heat and super-pressure are discussed in a folder published by the Hydraulic Press Manufacturing Company, Mount Gilead, Ohio.

Allen, Sproull & Allen, P. O. Box 626, Fort Worth, Texas, and the Continental Supply Company are distributors for these fittings.

Copies of the folder may be secured by writing for Bulletin 4302.

Handbook on Pyrometers

Complete instructions for the installation and care of thermo-electric pyrometers are contained in a handbook being distributed by the Brown Instrument Company, Wayne and Windrim Avenues, Philadelphia, Pa. As set forth in the foreword of the book, its purpose is to assist the installer and the user of pyrometers to obtain maximum satisfaction from the equipment. Copies of the book will be furnished upon application.

Complete List of Natural Gasoline Plants

(Continued from Page 37)

Name, Address, and Location	Type	Capacity
Tremayne Refineries, Long Beach—		
Santa Fe Springs	†	2,000
Huntington Beach (now being built)	†	.....
Union Oil Company, Union Oil Bldg., Los Angeles—		
Huntington Beach	†	10,000
Signal Hill	†	20,000
Santa Fe Springs	†	5,000
Santa Fe Springs (Now being built)	†	.....
Universal Refining Company—		
Santa Fe Springs	†	3,000
U. S. Refining Co., Metropolitan Theatre Bldg., Los Angeles—		
Santa Fe Springs	†	20,000
Ventura Refining Company, Santa Fe Springs—		
Venture-Newhall	†	4,500
Wadol Process Co., Pacific Finance Bldg., Los Angeles—		
Santa Fe Springs	†	20,000
Western Gas Company—		
Santa Fe Springs	†	3,000
White Star Gas Company—		
Santa Fe Springs	†	2,000
Wizard Oil Company—		
Torrance	†	1,000

RECENT REFINERY PATENTS ISSUED

BY STAFF REPRESENTATIVE

Washington, D. C.—The following patents, of interest to the refining industry, were issued during the month of June by the United States Patent Office:

No. 1,496,061, issued June 3 to Nathaniel E. Loomis, Elizabeth, N. J., assignor to Standard Development Company of Delaware. This is a process for recovering gasoline constituents from hydrocarbon gas which comprises passing said gas through a liquid absorbent for the gasoline constituents therein, thereby partially denuding the gas of said gasoline constituents, passing the residual gas through a solid absorbent, subsequently heating the solid absorbent to remove the gasoline constituents therefrom in vapor form and blending the gasoline constituents removed from the solid absorbent with the gasoline constituents contained in the liquid absorbent.

No. 1,496,090, issued June 3 to William M. Marker and William R. Allen, Ventura, Calif. This is for a separator for use in connection with an oil well, consisting of walls forming a horizontal chamber through which the fluid from the well is allowed to flow, chamber being of sufficient size with relation to the average flow of the well to allow a stratification of oil and water to take place therein; pipe means connecting said chamber with the well, of sufficient size to deliver fluid from well to chamber at the average rate of flow of well with a small drop in pressure, an oil header above the chamber; a water header below the chamber; a water riser connecting chamber with header; walls forming a vertical chamber in open communication with horizontal chamber and with water and oil headers; means for taking off water from the lower end of vertical chamber and means for taking off oil from upper end of vertical chamber.

No. 1,497,607, issued June 10 to August Streppel, Berling-Wilmersdorf, Germany, assignor to Deutsche Erdol Aktiengesellschaft, Berling-Schoneberg, Germany. A method for treating oil sand with a view to separating the oil from the sand, consisting in introducing the oil sand from above into a column of water of substantial height and causing upwardly directed steam jets to act upon the sand in the upper part of said column of water.

No. 1,498,069, issued June 17 to John C. Bertsch, Tulsa, Okla., assignor to the Bertsch Process Company, Wilmington, Del., for a method of recovering volatile fluids from liquids containing the same which consists in simultaneously heating said liquid and raising it to a barometric elevation, in subjecting the heated liquid to the partial vacuum maintained in a gas pumping system, in gravitating said liquid from said elevation into the atmosphere and in saturating the gas in said system with the fluids so liberated.

No. 1,498,528, issued June 24 to Philip T. Alexander, Sacramento, Calif., assignor of one-fourth to Arthur E. Miller, Sacramento, Calif., for an apparatus for the destructive distillation of oil-bearing materials, consisting of a retort unit for multi-chambered reduction furnaces, comprising an elongated relatively narrow chamber, vertically arranged partitions within said chamber, a series of scrapers arranged centrally of the unit between said partitions, drive mechanism arranged between the partitions and outer side walls of the unit, arms extending through endless slots in said partitions, for connecting the drive mechanism with the scrapers, and a guard member adapted to be moved with the scrapers along said endless slots to completely close the same.

No. 1,498,917, issued June 24 to Thomas William Stainer Hutchins, Davenham, England, for an apparatus for distilling coal, oil shale and the like including a substantially horizontal rotatable retort tube adapted to receive the material to be distilled, means for producing a head of pressure on the material at one end of said tube, a tumbler arranged in said tube extending parallel to the axis of said tube and having spaced arms extending outwardly from its longitudinal axis the spaces between the arms being open from end to end of the tumbler, said tumbler being of such size and weight as to move with the inner surface of the retort tube until the portion of the surface which the tumbler engages has moved upwardly to a predetermined extent, and at this time to tumble over and strike said surface with sufficient force to loosen any material tending to adhere to said inner surface.

New Company Organized To Run Amarillo Plant

Amarillo, Texas.—The Amarillo Refining Company has been organized with a capitalization of $400,000 to take over and operate the Reece S. Allen refinery located near Amarillo. This plant has a daily capacity of 1500 barrels, and has been standing idle for the past four years, owing to its remoteness from oil producing fields, but the recent development of the Carson-Hutchinson County field in the Panhandle district now affords an ample crude supply. Repairs and minor changes are being made to the refinery equipment, and it is planned to start operations about the middle of July. A small pipe line has been completed from the Panhandle oil field to the nearest point on the Santa Fe Railroad, and the crude will be moved from there in tank cars to the plant at Amarillo. The fuel oil output of the plant has been contracted for by railroads serving the Panhandle district, and it is planned to burn natural gas in the plant to fire the stills and boilers.

Colorado, Texas.—The first refinery to be erected in the Mitchell County field in West Texas was placed in operation during the latter part of June by the West Texas Refining Company, which is owned by the Anderson-Prichard Oil Corporation, Oklahoma City, Okla. This plant has a daily capacity of 1500 barrels, and is located near Colorado. A pipe line connects the plant with the oil field. Headquarters and sales office are maintained at Oklahoma City in the Colcord Building.

PIONEER
TANK &
BOILER
COMPANY
A New Name for an Old Friend
WHAT'S in a name, anyway? The refinery construction work we are doing under the name "Pioneer" is just the same high grade as when it bore the name "Tulsa Boiler and Sheet Iron."
For eighteen years, as the "Tulsa Boiler and Sheet Iron Works" we have turned out tanks and refinery steel construction that made good friends for us among the wise buyers of the Mid-Continent. We pioneered in giving these people "close to home" service on the best kind of work.
Now, under the new name, The Pioneer Tank and Boiler Company, we're all set with the men, machinery and money to keep on growing under the Pioneer banner like we did when Tulsa Boiler and Sheet Iron was on our letterhead.
There is no change in our organization.
Get Pioneer quotations on tank and refinery construction work.
PIONEER TANK & BOILER COMPANY
(Formerly Tulsa Boiler and Sheet Iron Works)
Box 1926, TULSA, OKLA.

Meter the Oil

GOING IN—GOING OUT—
UNDER THE BOILERS—
TO THE PRESSURE STILLS—
Wherever You Want Accurate Measurements—Use

EMPIRE
OIL METERS

The EMPIRE is a positive displacement device, operated by an oscillating piston. This design is entirely different from that of any other type of oil meter.

EMPIRE Oil Meters are made in all sizes, from 5/8" to 6", for both high and low pressures. Special types for special requirements.

Send for fully descriptive circular 109-R.

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Services Available for the Oil and Gas Industry As:

CONSULTING ENGINEERS in all matters pertaining to:

Pipe Line Transportation of Petroleum and Natural Gas
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MANUFACTURERS and DISTRIBUTORS of Gas and Oil Specialties, including:

Heat Exchangers
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Consulting and Contracting Engineers in Natural Gas and Oil.

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Mid-Continent Refinery Runs Show Good Increase During June—More Plants Run

Tulsa, Okla.—A comparison of Mid-Continent refinery runs as of July 1st over the first day of the previous month shows an increase of 5000 barrels per day. Almost the entire increase is credited to the state of Oklahoma. However, North Texas is contributing a larger amount than it was on June 1st. This is a material factor in offsetting the decrease shown in Kansas and North Louisiana.

Rumors prevalent during the month of June to the effect that some buyer was in the market for a large amount of gasoline for export was unfounded and the refiners of the Mid-Continent showed very little enthusiasm in the report.

The increase in runs to the refineries is taken as unusually small in comparison to the expected demand for the summer months. However, it will be remembered that many refineries had excess stocks on hand which had to be marketed before plants could handle additional crude. The action of the Carter Oil Company and the Carson Company was a great help in lowering the amount of stocks on hand.

The increase of approximately 13,000 barrels daily runs to the Cosden & Co. refinery at West Tulsa is responsible for the gain in Oklahoma. Reports of June 1st show that this company was running about 10,000 barrels daily while the current runs of the refinery are a little above the 23,000 barrels mark. As statistics show the consumption is running higher than last year and as the Cosden & Co. are understood to have a large number of marginal contracts on hand, the result of the increased runs is accredited to this source.

The plant of the Chestnut & Smith Corporation at Sand Springs, Oklahoma, has been shut down until the market situation is improved, according to statements of officials of that company. The plant was opened up last March after being closed down for over two years.

The increase in crude runs in North Texas has been brought about, in the major part, by the opening up of plants which have been closed down for the past three months. Refineries in that area which have again "fired their stills" are: The Primrose Refining Company of Wichita Falls, Petroleum Corporation of Electra and the skimming plant of the Mexia Oil and Refining Company at Mexia. The two first mentioned are running almost a thousand barrels each while the latter plant is taking about a hundred barrels per day. It is also reported that the refineries in North Texas have been able to purchase crude at 50 cents per barrel less than the posted price which is partly responsible for the increased runs. The Gulf Refining Company plant at Fort Worth has increased the crude runs about a thousand barrels per day and the Texahoma Oil and Refining Company of Wichita Falls is reporting an increase of 750 barrels in daily runs.

Mid-Contitnent Refinery Runs by Tabulation

State—	No. of Plants	Capacity	Running	No. S. D.	Now Running
Oklahoma	103	353,000	53	50	154,350
Kansas	39	117,200	20	19	64,300
North Texas	60	178,200	38	22	84,250
Louisiana	15	48,650	6	9	22,700
Arkansas	18	36,960	8	10	14,100
Missouri	5	17,400	3	2	8 000
Totals	240	752,310	128	112	347,700

Two thousand five hundred barrels of the total decrease of approximately six thousand barrels in the state of Kansas is marked up against the Sterling Oil and Refining Company of Wichita, the company now being in the hands of a receiver. Sinclair Refining Company of Coffeeville shows a decrease of 1500 barrels in daily runs, while the White Eagle Oil and Refining Company at Augusta and the Roxanan Petroleum Corporation at Arkansas City both show an increase of almost a thousand barrels each in daily runs.

In North Louisiana the loss in daily runs can be attributed to a general curtailment and not to any particular plant, with the possible exception of The Texas Company topping plant at Ardis, where a thousand barrel reduction is noted. Arkansas is reporting about the same amount of runs as it was on the first day of last month.

Natural Gasoline Shipments for North And West Texas Plants Off During June

Fort Worth, Texas.—Shipments of natural gasoline from the various manufacturing centers in North and Central West Texas during the months of April and May fell short of equalling the monthly average maintained during the first three months of this year. This decline in shipments occurred in the face of a few new plants, and additional equipment placed in operation on old plants early this summer, while the cause for the slump in shipments is attributed to soft spots in the natural gasoline market during these two months and also to the prevalance of hot weather, thereby increasing evaporation losses and holding down the gasoline yield. The most noticeable declines was from plants in Central West Texas, and also from plants that are partially supplied with gas from non-oil producing wells, which come under the state conservation rule of limiting the gas takings by a plant to the market available for the residue gas.

Natural gasoline shipments from Texas plants during the first five months of this year amounted to a total of 88,296,726 gallons, with the month of March leading with a total of 18,393,690 gallons. April shipments amounted to 17,895,192 gallons, while shipments during May declined to 17,066,490 gallons. The shipments for the first five months have averaged 17,657,345 gallons per month. The bulk of this blending product is moved to refineries on the Gulf Coast and Atlantic seaboard, while the remainder goes to refineries scattered over the Mid-Continent and interior points of the country. It is of interest to note that when naphtha and other light oils are added to this natural gasoline to manufacture a finished motor fuel a greater volume of motor fuel is created than is needed to fill the requirements of Texas, as gasoline consumption in Texas during April, as based on tax reports, was 26,496,100 gallons and during May taxes were paid on 29,958,700 gallons.

With the lid again clamped down on drilling operations in North and Central West Texas, and several of the major crude purchasing agencies prorating their daily crude runs in the latter district, the supply of new gas production will probably be reduced somewhat over the balance of the summer. This condition will serve to hold expansion programs in the natural gasoline industry in check, but will not materially affect the present gas supply of plants in operation, as all the crude purchasers are not prorating their runs.

Shipments for natural gasoline from the various manufacturing centers in Texas during April and May follow:

Fields—	April	May
Stephens County	126,455	107,175
Ranger-Eastland-Pioneer	115,375	111,700
Desdemona-Gorman	81.844	83 255
Burkburnett	55,420	64.130
Electra	20.850	24.960
Shackelford County	12,365	7,610
Young County	6,830	3,100
Petrolia-Clay County	4,810	2,405
Brown County	1,157	1,310
Amarillo-Potter County	970	700
Totals in Bbls. (42 Gals).	426,076	406,345

Bureau Studies Problems Of Refining Distillation

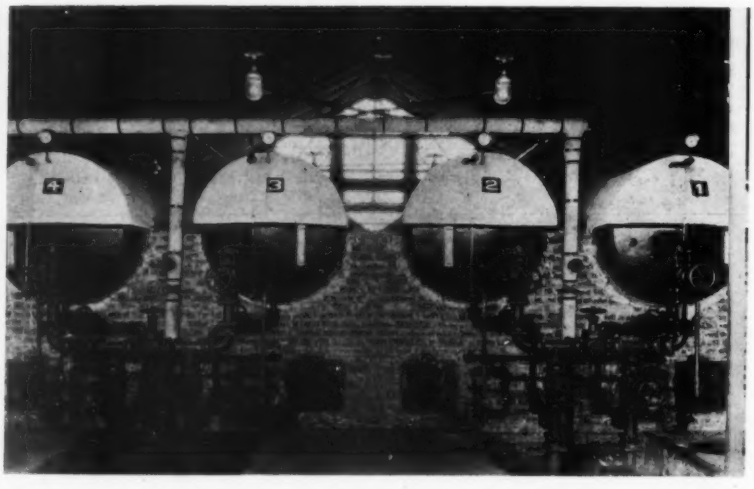
Washington, D. C.—An investigation of distillation methods applicable to refining petroleum is being made by M. P. Youker, senior refinery engineer, Department of the Interior, attached to the Bartlesville, Okla., experiment station of the Bureau of Mines.

Field tests have been made in refineries to determine the efficiency of various types of conventional distillation apparatus operating on a commercial scale. Laboratory tests have been conducted to determine the effect of reduction of pressure, the presence of steam and rate of vaporization on fractionation.

A study of the theoretical considerations involved indicated that the method of distillation that consists in first vaporizing as a whole all of the products to be separated from the crude oil and subsequently fractionally liquifying these products would probably prove to be the most advantageous method of separation. A bubbling type fractionating column, together with a pipe still and separator having a maximum capacity of 50 barrels per day was installed at the Bartlesville station of the Bureau of Mines for the purpose of determining what fractionating efficiency could be obtained by this method of distillation. Tests conducted with this experimental apparatus have shown that very satisfactory results may be obtained through the fractional liquifaction of mixed vapors by means of the bubbling type fractionating column. For example a 49 degree A. P. I. naphtha and a 33 degree A. P. I. gas oil were simultaneously separated from a heavy Bartlesville crude, no intermediate fractions being taken. The end point show by the Engler distillation of the naphtha was 397 degrees F., while the first drop from the Engler distillation of the gas oil came off at 419 degrees F. The results of these tests indicate that shell stills should be run in parallel rather than in series.

The information obtained in this investigation by the Bureau of Mines is to be applied on a commercial scale and further tests will be conducted. Preliminary arrangements have been made for the installation of fractionating columns in connection with shell stills to run crude oil and to redistill semi-refined stocks. The results of this investigation will be published shortly by the bureau.

WYATT METAL & BOILER WORKS



View of 4′ x 40′ Stills with one piece bottoms in plant of Roesser & Pendleton, Breckenridge

Another Wyatt's Equipped Absorption Gasoline Plant

The development of the absorption process of natural gasoline manufacture in Texas is inseparable from the Wyatt products. Without exception every plant of which we have record is in part or wholly equipped with steel plate work from our shops. Such results can only be accomplished by SERVICE.

Wyatt Metal and Boiler Works

Dallas, Texas

Largest Output Yet of Fuller's Earth Reported

The largest output on record of Fuller's earth in reported by the Department of the Interior, through the geological survey working in co-operation with the state surveys of Alabama, Florida, Georgia and Illinois, 15 operators in six states reported that 149,134 short tons of Fuller's earth were sold in 1923, valued at $2,247,523, or $15.07 a ton. This output is 7 per cent greater than that of 1922, but it is nearly four times the output of 1913. The value of the output for 1923 was the third largest that has ever been recorded, and was exceeded by that of 1920 and 1922. It was six times as large as that of 1913. Since 1920 there has been a steady decline in the average price per ton, the price in 1923 being nearly $4.50 lower than that of 1920.

The South continues to produce the greater part of the output. Florida was the leading state in output and value, as it has been from the beginning of the industry. Georgia was second and Texas was third in output and value. These three states reported about 92 per cent of the output and value in 1923. The producing states in the order of their output were Florida, Georgia, Texas, Illinois, Massachusetts and Alabama.

Imports of Fuller's earth, which at one time constituted the entire supply, reached their maximum quantity in 1914; since then they have on the whole declined and reached their lowest quantity in more than 25 years, 8547 tons. The value in 1923 was $113,944, or $13.33 a ton. The value of imported Fuller's earth in 1923 was the lowest since 1909.

W. B. Hamilton, president of the Texhoma Oil and Refining Company of Wichita Falls, is on an extended vacation trip accompanied by his family to a popular mountain resort in Colorado.

The Tourist Rush Is On

To the mountains, lakes, sea coasts and other summer resorts, thousands upon thousands of automobiles filled with tourists are now wending their way.

Delayed for a few weeks by bad weather, the rush is now on with redoubled activity.

The wise refiner, jobber and marketer is preparing himself for big business during the next three months; foolish ones are not.

All good motor fuel must contain its percentage of Natural Gasoline—the Pep of Petroleum.

Now is the time to engage your supply. Order today and be ready.

NATURAL GASOLINE
GRADES MANUFACTURED BY CHESTNUT & SMITH CORP.

NATURAL GASOLINE

GRADE "A"

Gravity	Not below 72° Be
	Not above 78° Be
E. P.	Not over 375° F
Recovery	Not less than 90%

GRADE "B"

Gravity	Not below 76° Be
	Not above 82° Be
E. P.	Not over 375° F
Recovery	Not less than 85%

GRADE "C"

Gravity	Not below 80° Be
	Not above 88° Be
E. P.	Not over 350° F
Recovery	Not less than 78%

GRADE "D"

Gravity	Not below 88° Be
	Not above 92° Be
E P.	Not over 350° F

MOTOR NATURAL GASOLINE

GRADE "1"

Gravity	Not below 58° Be
	Not above 62° Be
E. P.	Not over 437° F
Recovery	Not less than 91%

GRADE "2"

Gravity	Not below 58° Be
	Not above 62° Be
E. P.	Not over 450° F
Recovery	Not less than 90%

GRADE "3"

Gravity	Not below 64° Be
	Not above 66° Be
E. P.	Not over 440° F
Recovery	Not less than 88%

GRADE "4"

Gravity	Not under 66° Be
	Not over 70° Be
E. P.	Not over 435° F
Recovery	Not less than 85%

CHESTNUT & SMITH CORPORATION

GENERAL OFFICES ~ CHESTNUT & SMITH BLDG. ~ TULSA OKLA.

Tell them where you saw the ad

Vertical Evaporator in the Steam Distillation of Natural Gasoline

THERE are two general methods of evaporation or distillation of casing head gasoline from the absorption oil in absorption plant practice. One method is by use of the fire still and the second and preferable method is by steam distillation. The main objections to fire still distillation are the possibility of cracking some of the absorption oil, thereby discoloring the gasoline produced, and the fire hazard.

In building gasoline plants on the West Coast, the Southwestern Engineering Company was among the first to develop and perfect a vertical evaporator, according to the accompanying information which is taken from the Southwestern Bulletin.

The evaporators are cylindrical in construction; the standard diameters being 46, 60, and 72 inches, with a height of approximately 16 feet. The rich mineral seal oil before entering the evaporator is pre-heated to about 320 degrees F., and enters the evaporator 18 inches below the top. It is carried to the center to a distributor directly over a series of corrugated steps or riffles. The original oil flows downward over the steps or riffles in one direction for about 18 inches and then the flow is reversed. There are four sets of these riffles or steps for the rich oil to pass over, which gives a very good agitation, thereby allowing the light ends to escape. The oil collects at the bottom of the last riffle in a second distributor and from here it passes downward over a series of alternate pans and corrugated cartridges until it reaches the bottom. An open steam coil is submerged under a suitable oil level in the bottom of the evaporator for the admission of live steam at about 125-pound gauge pressure.

The final gasoline in the absorption oil is released in the lower part of the evaporator and the excess steam vapor, together with the gasoline vapor, passes upward through the corrugated cartridges and sweeps over the thin film of rich mineral seal oil that is passing down over the cartridges. There is an opening in the side of each pan which rests above each cartridge to allow this ascending vapor and steam to pass upward. This opening alternates with each pan, preventing by-passing and at the same time bringing the steam into close contact with the oil.

In this type of evaporator, no difficulty is experienced in stripping the rich oil to less than one-half of one per cent of its original enrichment. Due to the large vapor passage from the top of the first cartridge to the top of the evaporator, there is no danger of overloading the evaporator or causing it to throw oil or froth over from the top of the apparatus.

The gasoline vapor passes from the top of the evaporator to the lower, or reflux tower, of the dephlegmating unit. This tower is from 46 to 72 inches in diameter and is filled with reflux pans and trays, spaced on 16-inch centers. On top of the reflux tower a standard Southwestern control section is used for temperature control of the vapor going to the condenser.

The gasoline vapor passes around the tubes and the rich oil or cooling water, used as the cooling medium passes through the tubes. The rich oil, when used as the cooling medium in the control section, is taken from the heat exchanger at a point where it is properly tempered to give the desired vapor temperature and may be controlled either automatically or manually.

No difficulty is encountered in maintaining a very close regulation of the vapor temperature, which may range between say 160 and 220 degrees F., depending somewhat upon the pressure carried on the distillation system and upon the product desired. The vapor, after leaving the control section, passes to the upper tower or mist extractor. This tower consists of a centrifugal extractor with various baffles—the object being to knock down any entrained heavy ends that may have been carried over mechanically.

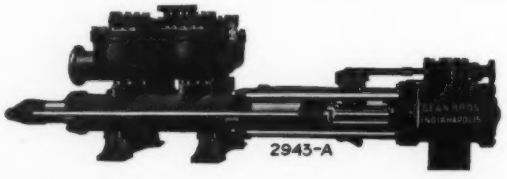
The knockout from the control section passes downward successively over the pans and trays in the reflux tower and any light ends knocked down by the control section are re-evaporated and carried upward through the control section, while the heavy

DEAN BROS. CO.
INDIANAPOLIS.

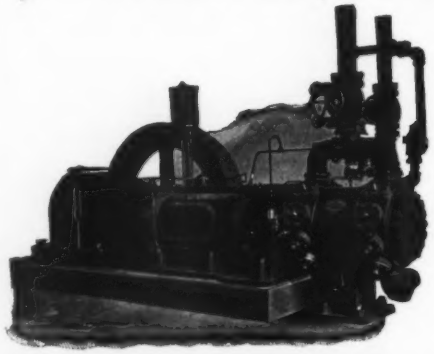
OIL PUMPS
For Hard Continuous Service

The pumps will not short stroke. Are substantially and carefully built. Have large and free passages which do not restrict the flow. Extremely economical in the use of steam.

Send for Catalogue.



Vilter Ammonia Compressors Fittings and Pipe Coils
Render Years of Reliable Service



Compressors built in several types and a great variety of sizes. Illustration is of a high speed type compressor.

Complete Data on Request

THE VILTER MFG. CO.
Established 1867
1152-1162 Clinton St. Milwaukee, Wis.

BRANCH OFFICE
413 Com'l Bank Bldg.
Houston, Texas

If you think there is any advantage in converting fuel oil into gas oil before cracking it, do it, but then run the gas oil through the Dubbs Cracking Process and obtain 40 to 50 percent yield of good gasoline in each throughput By no other method can you get equal results from gas oil

But why crack only 60 to 65 percent of your fuel oil obtained by first distilling it into gas oil, leaving a heavy flux or pitch bottom which requires good gas oil to be mixed with it before it is usable, when you can crack the entire 100 percent raw and direct to the process, and produce gasoline, gas oil and coke

What about producing residuum? Ask us

Universal Oil Products Company
Owners of the Dubbs Process
312 South Michigan Ave
Chicago Illinois

"Towers" and TAG

TO those engineers now engaged in working out the development of dephlegmating towers; and to all those who are interested in achieving highest operating efficiency on existing equipment of that nature, the Tagliabue Engineering Department offers— *Not only* its services with regard to Automatic Temperature Control, but *also* a line of Automatic Controllers now ready for such applications.

Without adequate automatic temperature control, without properly designed Automatic Controllers, control of end point of distillate cannot be achieved.

A word to the wise is sufficient.

We solicit inquiries from superintendents and plant engineers.

C. J. TAGLIABUE MFG. CO.
18-88 THIRTY-THIRD ST., BROOKLYN, N.Y.

ends are gathered in the bottom of the reflux tower and discharged by means of a tank float and control valve to be returned to the system.

This combination in all installations has delivered a 25 plus Saybolt color gasoline. The end point can be controlled to any desired point by varying the amount of cooling medium through the dephlegmator control section.

These features give an evaporator that is unsually compact; one that has liberal vapor spaces, making it practically puke proof; and the apparatus will equal or outstrip any other form of still with less steam and will operate equally well under pressure or partial vacuum.

Magnolia Builds Warehouse For Carbon Black Output

Breckenridge, Texas.—Four fireproof warehouses to store carbon black are being erected by the Magnolia Petroleum Company near its carbon black plant in Southern Stephens County, as result of the recent loss by fire of one of its big warehouses partially filled with carbon black. Magnolia is one of the largest manufacturers of carbon black in Texas, and now has approximately 1,000,000 pounds of this product in storage. Magnolia's plant is burning between six and seven million cubic feet of residue gas daily, and the gas yields about one pound of black per 500 cubic feet.

Power Plant Equipment Catalog

Power plant equipment covering hydromatic steam traps, steam and oil separators, junior feed wffater heaters, all service feed water heaters, cast iron exhaust heads, air separators, vertical and horizontal, sediment traps and strainers, and water level control valves is shown in a catalog of the Swartwout Company, Cleveland, Ohio. Copies of the book may be had upon application to the company.

Dresser Couplings Catalog

Catalog No. 18, of the S. R. Dresser Manufacturing Company, Bradford, Pa., is devoted to Dresser steel pipe couplings, sleeves, clamps, fittings, and other standard accessories for the construction, maintenance and operation of oil, gas, air, and water lines for wrought and cast iron pipe. Copies of the book may be secured by writing the company.

The Brown Instrument Company, Philadelphia, Pa., announces the appointment of R. D. Bean, as chief engineer. This company manufactures pyrometers, thermometers, tachometers and indicating and recording instruments.

Electrically Driven Centrifuges
Hand Centrifuges
WRITE
WILLIAMS, BROWN & EARLE, Inc.
Manufacturers of Laboratory Apparatus
918 Chestnut St. Philadelphia, Pa.

THERMIT
TRADE MARK REG. U.S. PAT. OFF. GREENWOOD PATENTS

The Advantages of Thermit Welding for Pipe Lines and Coils

No. 4

The entire equipment required for Thermit Welding your pipe is light, compact, and can easily be carried by one man.

The simplicity of the actual welding operation is described by our **Pamphlet No. 1628** which will be sent you on request.

METAL & THERMIT CORPORATION
General Offices
120 Broadway
New York City

CARBON BLACK
Channels, Angles, Roofing, Burner Pipes, etc. We are specialists in Carbon Black Building Material. Most of the buildings in Monroe, La., gas field and Stephens County, Texas, came from us.
WOOOWARD, WIGHT & CO., LTD.,
New Orleans, La.

SULPHURIC ACID
CHEMICALS
CARLOTS - CONTRACTS - LESS CARLOTS
Stocks—Tulsa, Houston, Dallas, San Antonio and Wichita Falls.
PHONE R 5641
JOE BARLOW, Distributor
DALLAS, TEXAS
2507 HARRISON ST.

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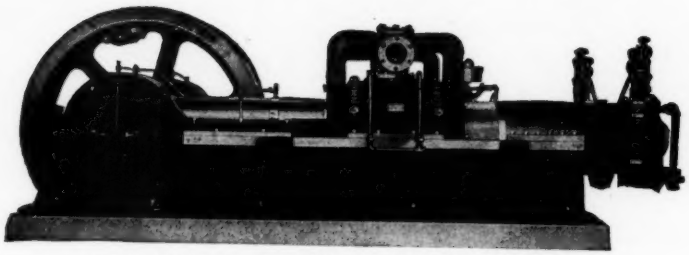
THE NEW ENCLOSED TYPE



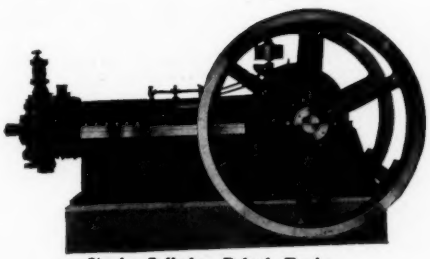
Direct Gas Engine Driven Vacuum Pump, Two Cylinder

Watts-Miller Gas Engines and Direct Gas Engine Driven Compressors and Vacuum Pumps

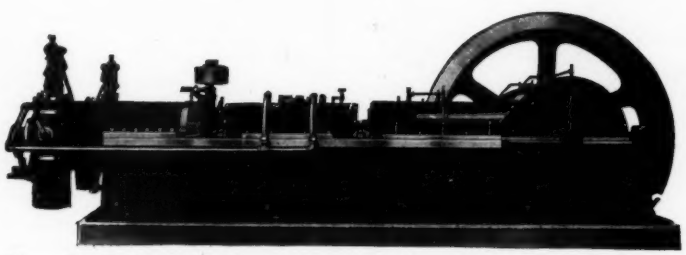
Pat. June 22, 1897; Oct. 6, 1914; April 13, 1915

High Efficiency Gas Engines, Compressors, and Vacuum Pumps for Power Plant Equipment

Sizes from 50 to 400 h. p.



Single Cylinder Belted Engine



Direct Gas Engine Driven Compressor, Two Cylinder, Single or Two Stage

Compressors particularly adapted to casing-head gasoline plants, gas pumping plants, and compressed air installations, in single and 2-stage machines to operate on practically all intake and discharge pressures. Continuous circulating filtering automatic oiling system.

The Miller Improved Gas Engine Co.

SPRINGFIELD, OHIO

WESTERN DISTRIBUTORS

C. E. Ingalls,
Rialto Building,
San Francisco, Calif.

Miller Improved Gas Engine Co.,
Branch Sales Office, also Warehouse and Service,
323 North Cheyenne Ave., Tulsa, Oklahoma

Frick-Reid Supply Co.,
Casper, Wyoming

Tell them where you saw the ad

÷ REFINERY SUPPLIES ÷

Refiners' Supplies

	July 14
Soda Ash light 58%.....cwt.	$1.38
Silicate of Soda 60 deg. bbls....cwt.	1.70
Sal Soda wks .....cwt.	1.10–1.25
Caustic Soda 76% .....cwt.	3.10
Chloride of Lime solid .....cwt.	1.90–2.10
Sulphuric Acid 60 deg. tank cars	
f. o. b. shipping point.....per ton	9.00–10.00
Benzol—	
Pure Water White.....Tanks....gal.	.24 —.25
Drums....gal.	.30 ....
90% . .....Tanks....gal.	.23 ....
Drums....gal.	.28 ....

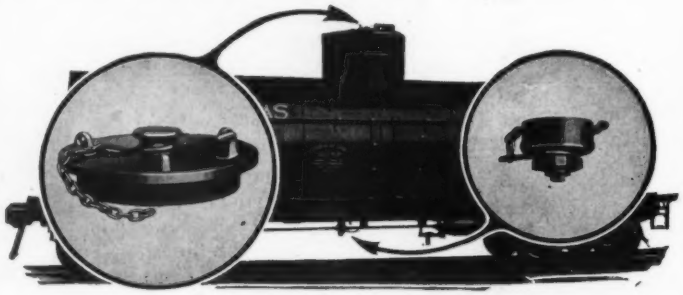
Jobbers' Supplies

Vegetable Oils—	
*Linseed, carloads Spot.....gal.	—.94
June-August . .....gal.	—.94
Less carload Spot .....gal.	—.97
5 bbls. or less Spot.....gal.	—.99
Boiled, tank Spot .....gal.	—.90
Boiled, carloads Spot.....gal.	—.96
Soya Bean Spot, Tanks.. lb.	—.10¼
Animal Oils—	
English Degras .....lb.	.05¼
Domestic Degras bbls. carloads ...lb.	.05
Horse . .....lb.	.08

Take Care of the Little Things

— and the big things will take care of themselves

Outlet caps and dome covers sometimes seem of little importance, but they have been known to cause a lot of trouble.



Insure Your Own Safety

It costs no more to entrust your work to us. But it does give you the advantage of our long experience—our high standards and guaranteed quality. Let US be responsible for the refinery equipment.

Dome Covers and Outlet Caps — Stock Specialties

Brake Shoes, Gray Iron Castings, Plate Work, Beams, Sheet and Structural Steel. Quotations on request.

Order by Wire or Letter

Oil Well Rig Irons and Refinery Equipment

Western Iron & Foundry Co.

Wichita, Kansas

Oleic Acids—

Dist. . .....lb.	—.08½
Saponified . .....lb.	—.08¾

Lard Oils—

Prime

Winter

Strained . ..1 to 1½ ffa. 40/45c t. lb.	.13¼

Extra

Winter

Strained.....2 to 4½ ffa. 40/45c. t. lb	.11¾
Extra .....4 to 5 ffa. 40/45c. t. lb.	.11¼
Extra No. 1....7 to 10 ffa. 40/50c. t. lb.	.11
Extra No. 1..15 to 18 ffa. 40/50c. t. lb.	.10¾
No. 2.....22 to 23 ffa. 40/45c t. lb.	.10¼
Prime Edible Tallow under 1⅞ ffa.	
40/45c. t. N. Y.....lb.	—.09¾
Tallow acidless .....lb.	—.11¼
Lard Stearine .....lb.	—.13½
Oleo Stearine .....lb.	—.09⅜

Neatsfoot Oil—

Pure . .....bbls.-lb.	—.15
Extra . .....bbls.-lb.	—.10¾
No. 1 .....bbls.-lb.	—.10¼
Cold pressed .....lb.	—.19½

Fish Oils—

Menhaden Oil

Light pressed .....gal.	.57–.60
White . .....gal.	.63–.65
Yellow bleached .....gal.	.61–.63
*Herring, tankcars coast.....gal.	—.50
Whale, extra winter bleached ....gal.	—.81
Seal	Nominal

Naval Stores—

Turpentine, N. Y. .....gal.	.85
†Turpentine . .....gal.	.77½
Rosin B. N. Y. .....bbl.	5.60
Rosin F. N. Y. .....bbl.	5.85
Rosin B.† .....bbl.	4.30
Rosin F.† .....bbl.	460
Rosin Oil 1st run .....gal.	.40
Rosin Oil 2nd run .....gal.	.45

Pine Tar—

Kiln Burnt .....Bbl.	10.50
Retort . .....Bbl.	10.50

*Nominal.

†Savannah, Ga., market.

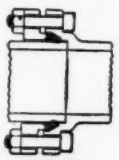
Refinery Catalogs Issued By Marion Supply Co.

Several catalogs have been issued recently by the Marion Machine Foundry & Supply Company, Marion, Indiana, which will be of interest to refiners.

Below is listed the titles of the different catalogs: The Marion Master Grate, The Marion Line of Hand Stokers, and Marion Power Plant Equipment.

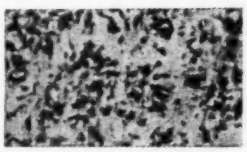
Each of the three catalogs is complete in its field and copies can be secured by writing the company.

SIMPLEX CAST IRON CONDENSER PIPING

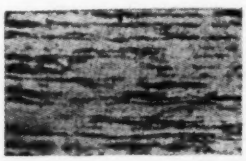


"ONE FLANGE IS LOOSE"

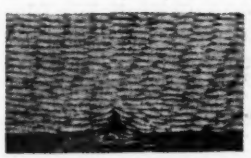
COATS ITSELF



Photomicrograph of cast iron, much enlarged, showing granular structure.



Photomicrograph of wrought iron, much enlarged, showing fibrous structure.



A piece of sheet steel, much enlarged, showing surface and sectional structure with a typical pit.

AUTHENTIC data from over 250 years of service prove that cast iron becomes coated with rust but remains practically unimpaired in weight and strength under conditions that are fatal to other kinds of metal.

Scientists believe this phenomena due to the microscopic structure of cast iron —a structure of the same granular or crystalline form as found in the iron ore from which it is made and which has laid unimpaired in the ground for untold centuries. Cast iron rusts on the surface, but the corrosive agent fails to break the natural mechanical bond between the irregular shaped granules, further oxygen is excluded by the first rust coating, and therefore corrosion stops. Cast iron literally coats itself.

In place of the interlocked grains or crystals of cast iron, wrought iron and steel are of a fibrous and, in thinly rolled steel, of a laminated structure, with distinct leaves overlapping each other. As corrosion takes place, these leaves or fibres scale off, constantly presenting a fresh surface to the corrosive agent.

Simplex pipe is flanged pipe minus the limitations of a joint made with rigid flanges. Thousands of feet of this material has been in use for years by the leading oil refineries of the United States for oil condensers.

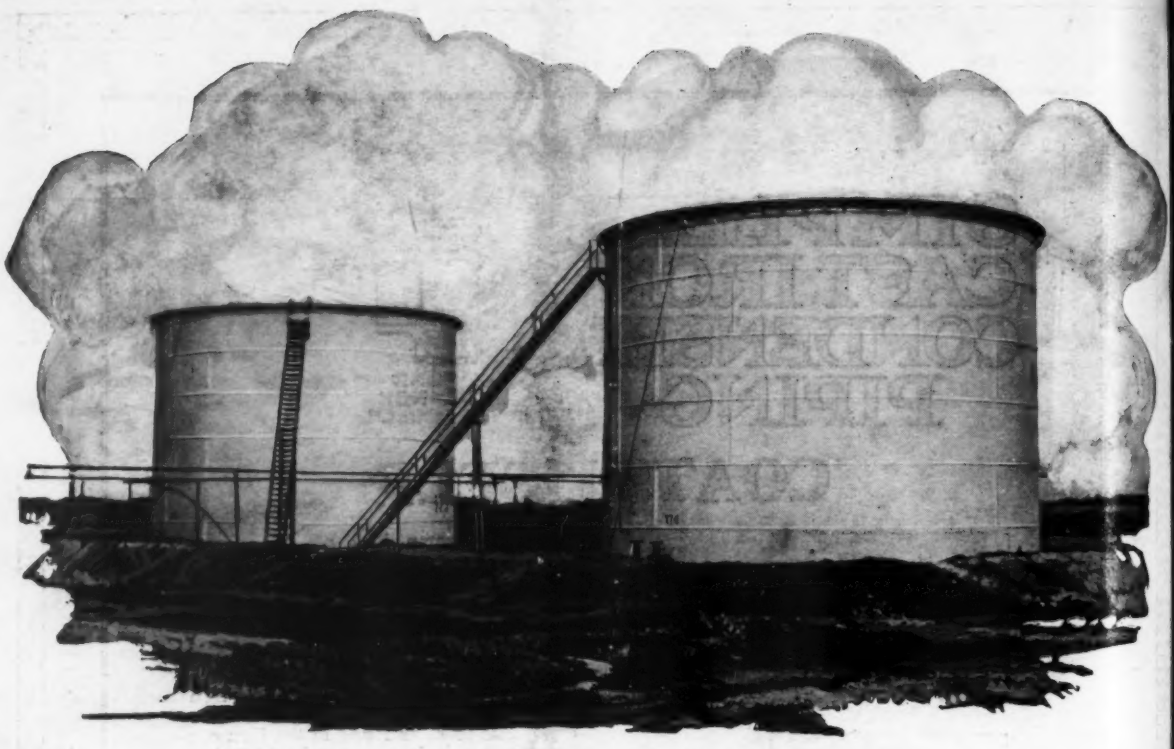
Write for Simplex Condenser Catalog Number 55

AMERICAN CAST IRON PIPE COMPANY

General Offices and Foundry: Birmingham, Ala.

Branches at
Dallas, Kansas City, San Francisco, Los Angeles, Chicago, New York

Write Also for Information on Our Prepared Joint Cast Iron Pipe for Oil Lines



Aluminum Tank Paint Cuts The Loss

The use of Degraco Aluminum Tank Paint provides the highest degree of light reflection and the lowest degree of heat absorption that can be obtained by any practical method for cutting down evaporation losses.

Actual field tests have shown that tanks on which this paint is used remain so cool that there is no need to resort to water spraying or other artificial methods of cooling. The result is a saving that amounts to far more than the relatively low cost of painting and maintenance.

Degraco Aluminum Paint is not easily stained by oil leakage — nor is it darkened by hydrogen sulphide fumes as are so many paints when exposed to oil field conditions. The reason for this is that the Degraco Aluminum Paint Formula *provides the right blend of vehicles and pigment* to meet the known conditions of exposure and service.

Send for complete information on Degraco Aluminum Tank Paint including data on tests of its effectiveness in reducing evaporation losses.

Degraco Products

—

Tank Paints
Head Liner Enamels
Tank Car Paints
Pipe Line and Station Finishes
Superior Graphite Paint
Sta-White
Degraco Paints for Houses
Degraco-Tone

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DEGRACO PAINTS

All Colors for Your Particular Needs

(223)

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512 Twelfth Street

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Manufactured in Canada by Dominion Paint Works, Limited, Walkerville, Canada

DEGRACO PAINTS are sold through branch offices with warehouse stocks in all principal cities.

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